Province of the
EASTERN CAPE
EDUCATION

EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE
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2023 NSC CHIEF MARKER'S REPORT

SUBJECT	**PHYSICAL SCIENCES**		
QUESTION PAPER		**TWO**	
DURATION OF QUESTION PAPER	**3 HOURS**		
PROVINCE	**EASTERN CAPE**		
DATES OF MARKING	**4/12/2023 TO 21/12/2023**		

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

Rasch analysis reveals that the candidates' average score for the paper is 48 % based on the 100 scripts sample.

The population size has increased by 0,59% (35 088 learners in 2022 to 35 298 learners in 2023)

The questions that scored the highest % are:

Question 2 (Organic molecules) with a score of 63%.

Question 3 (Physical properties of Organic Compounds) with a score of 55%.

Question 1 (Multiple Choice Questions) with a score of 54%.

Question 4 (Organic Chemistry reactions) with a score of 53%.

Poorly performed questions include:

Question 8 (Galvanic Cells) with a score of 40%.

Question 6 (Chemical Equilibrium) with a score of 42%.

Question 7 (Acids & Bases) 43%.

Question 9 (Electrolytic Cell) with a score of 46%.

The following sub questions were poorly answered by candidates:

1.6 Chemical equilibrium (Kc) (31%)

1.7 Acids & bases (pH, conductivity, neutralisation) (19%)

3.3 Organic Chemistry (Structure of compounds, strength of intermolecular forces and energy required to overcome bonds) (21%)

3.6 Physical Properties of Organic Compounds, interpretation of a graph) ((31%)

5.2 Rate and extent of reactions (independent variable) (35%)

5.3 Rate and extent of reactions (calculation of concentration) (10%)

6.5 Chemical equilibrium (Equilibrium graph interpretation) (32%)

6.6 Chemical equilibrium (Equilibrium graph explanation) (6%)

7.3 Acids & bases (calculation) (31%)

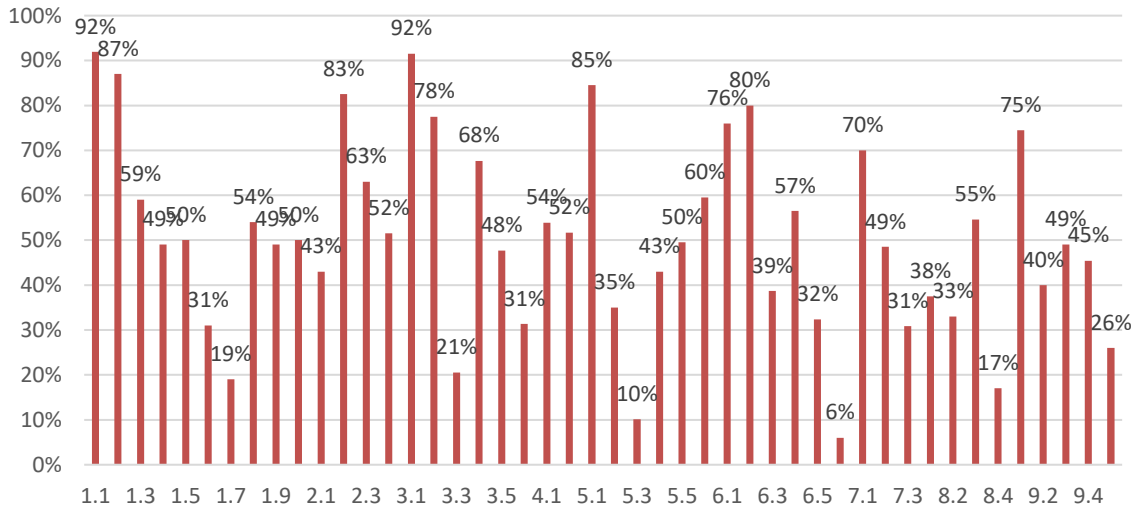
8.1 Galvanic cells (38%)

8.2 Galvanic cells (relative strengths of oxidising / reducing agents) (33%)

8.4 Galvanic cells (function of salt bridge explanation) (17%)

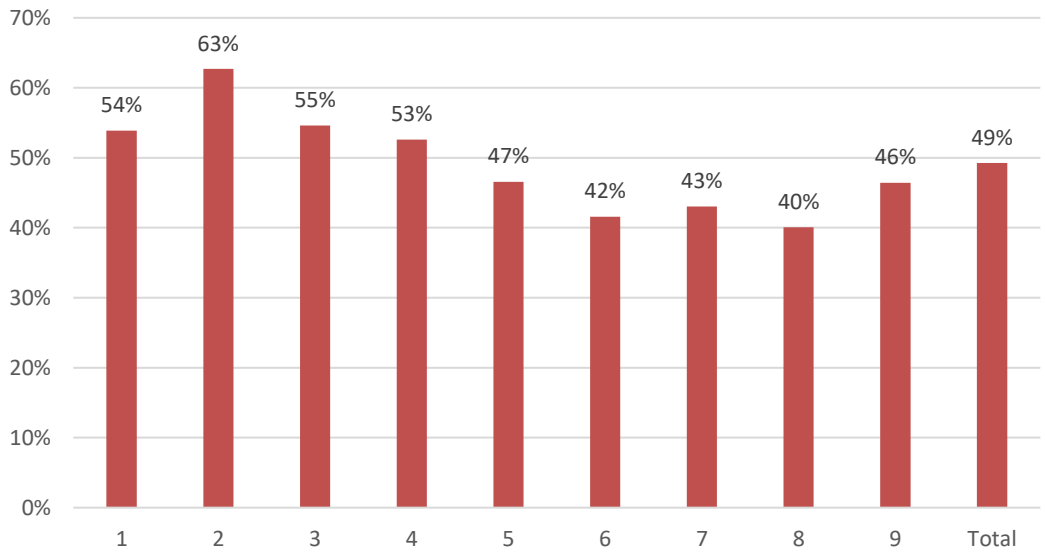
9.5 Electrolysis (Use of Table of Standard Reduction Potentials)(26%)

The graph below shows the average percentage per sub-question in the 2023 NSC examination, based on information from the Rasch analysis.



The table and graph below show average percent per question in 2023 NSC exam based on information from the Rasch analysis

QUESTION NUMBER	TOPICS	AVERAGE %
1	Matter and materials, Chemical change and chemical systems	54
2	Organic molecules	63
3	Organic molecules-physical properties	55
4	Organic molecules-organic reactions	53
5	Reaction rates	47
6	Chemical equilibrium	42
7	Acids and bases	43
8	Galvanic cell	40
9	Electrolytic cell	46
Total		**49%**



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?
• Candidates recorded a score of 54%, higher than the 48% scored in 2022.
• Candidates did well in sub-questions Q1.1 (92%), Q1.2 (87%)
• Sub-questions poorly answered were Q1.6 (31%), Q1.7 (19%)

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
Q 1.6 • Candidates did not know that an increase in volume meant a decrease in pressure. Candidates did not take the solid phases of the CuO and the Cu_2O into account when answering this question.
Q 1.7 • Candidates have a poor understanding of the pH value, electrical conductivity and base required for neutralization for a strong acid vs a weak acid.

(c) Provide suggestions for improvement in relation to Teaching and Learning
Q1.6 • Educators must look at the various factors affecting the equilibrium position. Then consolidation must be done on how a shift in equilibrium position will affect the concentration / number of moles of reactants and / or products as well as the value of the equilibrium constant.
Q1.7 • Educators must link the definitions of strong acid / strong base; weak acid / weak base to the pH values, electrical conductivity and neutralisation of these acids & bases.
• Learners memorize factors affecting equilibrium without understanding it. Educators must apply English Across the Curriculum (explaining factors so that learners will understand it). • Educators must guide and learners must practice the skill of eliminating incorrect answers. • Assessing multiple choice on a regular basis in tests and include multiple choice questions in all topics, using past papers. • Educators must teach all the content that learners are supposed to learn according

to the Examination Guidelines and ATP.

- Using past papers as a resource for revision to expose learners to different types of questions.
- Subject Advisors / Lead teachers / Teachers should compile a booklet of MCQ arranged according to topics for schools. These questions can be used for weekly assessments.
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(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.

- Learners must be taught not to leave multiple choice questions unanswered as there is no negative mark for an incorrect answer.

QUESTION 2

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

Q 2

- Was answered well.
- The average score for question 2 was 63%.

- The sub-question with the lowest score was 2.1 (43%) – definition of "*organic compound*".
- Question 2.2.2 was answered well (83%).

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

Q 2.1

- Common mistake: Candidates provided the definition of "*hydrocarbon*" instead of "*organic compound*".

Q 2.2.2

- Many candidates could identify the correct chain length, 4 carbon atoms = but-, but got the suffix -anone wrong.
- Some candidates omitted the -2- in the name.

Q 2.3.2

- Many candidates wrote Fl- as the symbol for fluorine instead of F.

Q2.3.4

- Many candidates drew the structural formula of compound F; not the functional group.

Q 2.3.5

- Many learners wrote 1-methanol
- The learners are not following the rules for IUPAC naming.

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

- Rules on nomenclature should be taught and practiced regularly when teaching IUPAC naming.
- When a compound consists of only ONE or TWO carbon atoms, numbering must NOT be used to indicate the position of the functional group
- Examination Guidelines 2021 Pg 18 , Chief Marker's Report and the DBE Diagnostic report should be used WITH the CAPS documents when preparing and planning for a lesson (so that educators can see the depth/extent of a specific topic).
- Develop exercises that address the IUPAC naming.
- Teach learners the structural formulae of the functional groups of the different homologous series.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
Q 2.1 • A common error was providing the definition of "*hydrocarbon*" instead of "*organic compound*".
Q 2.2.2 • Many candidates got the stem of the name correct. The challenge is on the separation of the word and number with a hyphen and the incorrect suffix -anone.
Q 2.3.2 • Candidates do not know their Periodic Table. Many candidates wrote Fl as the symbol for Fluorine.
Q 2.3.5 • Most learners got the stem of the name correct. The challenge is on separation of word and number with a hyphen, omission of di- as well as incorrect order of substituents in the name. Candidates must get more exercises on IUPAC naming.
General observations: • Candidates do not draw all the bonds or all the hydrogen atoms • Candidates drawing the entire structure instead of only the functional group.

QUESTION 3

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

- Candidates recorded a score of 55%.

- This question was answered fairly well, with learners scoring 92% in Q3.1 and 78% in Q3.2.
- Candidates performed the worst in Q3.3 (21%) and Q3.6 (31%).

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

Q 3.3

- Candidates could not provide a reason for their answer to Q3.2. Candidates did not know the difference between bonds and intermolecular forces. They respond by saying, "more energy required to break bonds". Some refer to "bonds between atoms" instead of "intermolecular forces" or just stated that "C needs more energy" without stating what the energy is needed for. Candidates do not refer to the strength of the intermolecular forces. They just mention the type of force without referring to the strength of the intermolecular force.

Q 3.6

- Many candidates were writing about isomers. They did not link this question to the graph even though the question clearly states that "A and B were used in this investigation".
- Candidates failed to compare the strengths of the intermolecular forces of A (aldehyde) and B (carboxylic acid).

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

Q 3.3

- Emphasize the difference between bonds between atoms in molecules (intramolecular) and forces between molecules (intermolecular) and that the strength of the intermolecular forces are responsible for the different phases. Inter-atomic or intramolecular forces which are much stronger that intermolecular forces are formed or broken during chemical reactions, when new compounds are formed. Intermolecular forces are overcome, not broken, during phase change.

Q3.6

- Practical skills need to be taught from grade 10 to grade 12. Learners lack skills such as identification of variables and writing of conclusions. The difference between an investigative question, hypothesis and a conclusion should be thoroughly explained.

Q3.4.2 & Q3.6

- When writing explanations related to physical properties of compounds, learners

should be taught to follow the following steps:

Comparing compounds from the same homologous series:

1. Compare the surface areas of the compounds.
2. Compare the strength of the intermolecular forces.
3. Compare the energy needed to overcome the intermolecular force.

Comparing compounds from different homologous series:

1. State the type of intermolecular force in each compound.
2. Compare the strength of the intermolecular forces.
3. Compare the energy needed to overcome the intermolecular force.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
• Use of Examination guidelines as source of correct definitions for concept cannot be over-emphasized.
• There are centres that still use the phrase "break bonds" in place of "overcome intermolecular forces". This has to be brought to the attention of teachers as this leads to loss of marks. The candidates learn this phrase from their teachers and use it in their explanations.

QUESTION 4

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

- Candidates recorded a score of 53%.
- Question 4.1 scored the highest at 54 % while question 4.2 showed the lowest performance at 52%.

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

In general this question was answered fairly well. Common errors included:

- Incorrectly balanced chemical equation (4.1.3). Candidates using fractions when only whole numbers are accepted as correct.
- Incomplete or incorrect definition (4.2.1)
- Structural formula with bonds or hydrogen atoms which are missing (4.2.3)
- Chlorine written either in capitals (CL) or small letters (cl) (4.2.3)
- Dehalohydrogenation instead of dehydrohalogenation (4.2.7)

Q 4.2.3

- Candidates had to move from the condensed structural formula in reaction II to work out the structural formula of B in reaction I. If candidates became confused with the positional isomers A and B, they would incorrectly identify B.

Q 4.2.6

- Many candidates wrote "concentrated base", "diluted base" or "strong base" instead of "concentrated strong base" or "strong base in ethanol". Candidates cannot differentiate between a strong base and a concentrated base.

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

- Learners must count the number of bonds after they draw the structural formulae.
- It is advisable for teachers to do these experiments so the learners can get used to the reaction conditions.
- Educators and learners must be made aware that the functional groups of the different homologous series are in the CAPS and Examination guidelines.
- Emphasise the difference between structural-, condensed structural – and molecular formulae.
- Learners need a thorough knowledge of the different prescribed Organic reactions and their conditions to analyse flow diagrams. They must be prepared to analyse given data and devise steps to prepare a given compound using the reactants supplied; being able to go from one reaction to the next. They should also be able to work backwards (work out the reactant) when given a product. Subject advisors should assist teachers in compiling summaries of the different types of reactions and their

conditions to enable learners to memorise the required facts.

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

- Candidates did not know the difference between structural formulae, condensed formulae and molecular formulae. Candidates cannot differentiate between a strong base and a concentrated base. Candidates used dehalohydrogenation instead of dehydrohalogenation to describe the elimination reaction.
- Candidates must study definitions using the Examination Guidelines.

QUESTION 5

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

- Candidates recorded a score of 47%.
- Question 5.2 scored the highest at 85 % while question 5.3 showed the lowest performance at 10%, with question 5.2 recording a score of 35%.

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

Q5.1

- Candidates are using "rate" and "per unit time" in the same sentence. This means candidates do not know the meaning of the word "rate".

Q5.2

- Candidates were unable to identify the independent variable.

Q 5.3

- Candidates struggled to do this calculation with information given in the table. They had difficulty in interpreting the information given in the graph. The words "Run 1", "Run 2" and "Run 3" were also new to them.

Q5.4

- Candidates failed to calculate the reaction rate in $g.s^{-1}$. They calculated moles and hence the reaction rate in $mol.s^{-1}$.

Q5.5

- Many candidates struggled to draw the correct Maxwell-Boltzman distribution curve. Mistakes made included:
  - axes labelled incorrectly
  - both curves not starting at the origin
  - peak of curve B being higher than curve A
  - curves not labelled

Q5.6

- Many candidates omit key words like "more"/'' effective''/''per unit time'',e.g., leaners only write ''effective collision per unit time'' or '' molecules have enough kinetic energy" or "more effective collisions".

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

Q 5.2

- The teaching of "Scientific Investigations" are very important. Candidates must be exposed to scientific investigation questions from grade 10.

When teaching reaction rates educators should:

- Educators should do experiments of different factors when teaching rate of reactions and asses the learners on the experiments.
- Assessment of experiments should include writing the different variables, hypotheses, conclusion, drawing of graphs, interpreting of graphs and different types of

stoichiometric calculations.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
• Judging by learner responses there is a misconception in learners about rate of reaction and shift of equilibrium position.
• Educators should teach and assess learners on how the Maxwell-Boltzman curve changes depending on which factor affecting reaction rate is being investigated.
• Learners wrote "equilibrium reached". Emphasis should be placed on the difference between reversible and non-reversible reactions. Reversible reactions can reach equilibrium, while non-reversible reactions take place in one direction and cannot reach equilibrium. Furthermore, a reversible reaction can only reach equilibrium in a closed system. When written, equilibrium reactions are indicated with double arrows. Single arrows indicate non-reversible reactions.
• Ensure that learners know the different factors affecting reaction rate and how the Maxwell-Boltzman curve will change.

QUESTION 6

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

- Candidates recorded a score of 42%.
- Question 6.2 scored the highest at 80 % while question 6.6 showed the lowest performance at 6%.

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

Q 6.2

- Incorrect of incomplete definition of Le Chatelier's principle.

Q 6.3.1

- Instead of APPLYING Le Chatelier's principle, many candidates simply re-phrased the answer to 6.2.

Q 6.6

- Most candidates could not interpret the number of moles vs time graph.
- Candidates used Collision Theory to explain the effect of a catalyst, and forfeited the marks because they did not refer to the graph in their answer.

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

Q 6.1 & Q6.2

- Educators should use the examination guidelines for definitions.
- Educators should stop using textbooks for definitions. Different textbooks have different definitions.

Q 6.3, Q6.5 & Q6.6

- Educators should assess learners in ALL the factors effecting chemical equilibrium.

Q6.5

- When explaining answers in terms of le Chatelier's principle, the following guide will assist:

1. Mention the disturbance.
2. Describe the rule for the disturbance e.g. the disturbance in this question was a decrease in temperature.
3. Mention which reaction is favored by the disturbance, eg Forward reaction or reverse reaction.

Q 6.6

- Educators should teach and assess learners on all the different type of graphs on a regular basis. Learners must know how to explain the changes happening to the equilibrium, in words.

(d) Describe any other specific observations relating to responses of learners and comments

that are useful to teachers, subject advisors, teacher development etc.
Q 6.2 • There are still learners using the word "stress" instead of "disturbance",e.g., " when the stress is applied on a system in equilibrium, the system will shift in such a way to overcome the stress" . The correct definition is in the Examination Guideline.
Q 6.4 • Learners wrote the wrong Kc expressions, e.g., $K_c = \frac{[AB]}{[A][B\}}$ / $K_c = \frac{[A][B]}{[AB]^2}$
• Teachers should avoid using of $K_c = \frac{[products]}{[reactants]}$ in class. Instead, use chemical equations to teach the writing of Kc expressions.
• Candidates did not need to use the table to solve Q6.4. However, many used the table. When using a table to solve Kc calculations, learners should be taught to use correct labels [n(initial), n(change), n(equilibrium), c(equilibrium)] in the table and write the correct values next to each label. Use previous marking guidelines to show learners the labelling in such tables. Learners need to be reminded that equilibrium concentrations and NOT moles are used in the Kc calculation.

QUESTION 7

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

- Candidates recorded a score of 43%
- Question 7.1 scored the highest at 70% while question 7.3 showed the lowest performance at 31%.

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

Q 7.1

- Some candidates defined a strong base as having a high concentration of *hydronium* ions.
- Many candidates wrote "dissolved" instead of "dissociate" or "ionizes", meaning there is a misconception.

Q7.2.1

- Candidates forgetting to convert cm^3 to dm^3.

Q 7.2.2

- Many candidates wrote pH = -log $[OH^-]$. They copy incorrectly from formula sheet.

Q 7.2.3

- This was a higher order question.
- Candidates did not know they had to calculate the mole HNO_3 reacted by subtracting the excess mole HNO_3 from the initial mole HNO_3
- Many candidates failed to use the 85% purity in this calculation.
- Candidates were rounding off to one decimal place.

(c) Provide suggestions for improvement in relation to Teaching and Learning
Q 7.1.1 • Differences between strong acid and strong base: hydronium (oxonium) ion and hydroxide ion respectively. Use Examination Guidelines for definitions.
Q 7.2.2 • Do exercises that will afford learners opportunity to calculate pH.
Q 7.3 • Educators should do the titration experiment and do an informal assessment on titration calculations. • Again, stoichiometric calculations are very important. • Educators should emphasize the importance of units. There is a general rule that states, no unit no marks for final answer.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
• Subject advisors should do advocacy on using experiments as a teaching approach in this topic. Practical work to include testing pH of solutions using Universal indicator and titrations.
• Teachers need to take some time, when teaching pH. Educators must also give learners time to practice the mathematical concept of converting between logarithmic form and exponential form. Logarithms are no addressed extensively in the mathematics syllabus as it was the case in the past.
• Learners should be taught to copy formulae correctly from the data sheet, especially the pH formula.
• Learners should be taught to label formulae when doing multistep calculations, eg. When calculating the number of moles of HNO_3, the formula should be as follows: • $n(HNO_3) = cV$.
• Ensure that stoichiometric calculations are properly taught in Grades 10 and 11. Candidates must know the difference between a limiting reactant and one that is in excess. A reactant in excess has an initial number of moles, the number of moles that reacted and the number of moles in excess.
• Rounding off should only be done at the final answer of the calculation. Learners should be taught not to round off in each step as it leads to an incorrect answer.

QUESTION 8

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

- Candidates recorded a score of 40%.
- Question 8.3 scored the highest at 55 % while questions 8.4 showed the lowest performance at 17%. Questions 8.1 and 8.2 also scored very low at 38% and 33% respectively.

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

Q 8.1.1

- Candidates wrote could not write an observation. Many wrote "*reduction*".

Q 8.1.2

- Many candidates did not know how to use the standard reduction potential table to identify the oxidising agents. E.g., Many leaners wrote that Ag is an oxidising agent
- Some candidates wrote the half-reaction: $Ag^+ + e^- \rightarrow Ag$

Q 8.2

- Candidates do not understand the concept redox (reduction and oxidation).
- During the comparison, learners only wrote higher of lower by referring to the table.
- Many candidates used Cu^+ instead of Cu^{2+}

Q8.3.3

- Some candidates wrote the cell notation.
- Candidates used capital letters for AG and / or CU.
- Many candidates calculated the cell potential for this redox reaction.
- Some candidates included the number of electrons on both sides of the arrow.

Q8.4

- Many candidates identified NO_3^- as the ion that will move into the silver ion solution.
- Learners who correctly identified K^+ as the ion that will move into the silver solution, could not provide a reason for their answer.
- There is a misconception that the salt bridge separates the anode from the cathode, and it transports electrons.
- Many candidates gave the function of the salt bridge as a reason. Others said "maintain neutrality", instead of "electrical neutrality".

(c) Provide suggestions for improvement in relation to Teaching and Learning
Q 8.2 • Educators must use the standard reduction potential table when teaching redox reactions. • They must show the learners where you find the oxidising - and reducing agents on the table. (Left hand side of the table is the oxidising agents and right-hand side is the reducing agents) • Educators should start in grade 11 teaching the standard reduction potential table, when teaching redox chapter.
• Educators should make the data/formula sheet available to all learners before they start with a specific topic.
• Learners must be taught that the number of electrons on the left hand side of the arrow and those on the right hand side of the arrow must cancel.
• Educators should conduct more informal experiments.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
• Educators need to spend time teaching learners how to use the table of reduction potentials correctly. This section is taught at the busiest of times (third term). Teachers have to find time to avoid rushing when teaching Electrochemistry.
• Concepts such as reducing agent, oxidation, oxidizing agent and reduction should be taught with understanding. It starts in Grade 11.

QUESTION 9

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

- Candidates recorded a score of 46%.
- Question 9.1 scored the highest at 75% while question 9.5 showed the lowest performance at 26%.

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

Q 9.1

- Many candidates wrote the definition of an electrolyte, "electrical energy is converted to mechanical energy" or "chemical energy is converted into electrical energy, and forfeited the marks.

Q 9.2.

- Many candidates wrote the oxidation half-reaction.

Q 9.4

- It was a high order question.
- Candidates cannot distinguish between different ''n's'' e.g.,

1. n for moles in n =m/M.
2. n for number of electrons in $n = Q/q_e$.
3. n for number of particles in $n = N/N_A$.

- Most candidates could not integrate concepts learnt in Physics in Chemistry.
- Candidates did not use Avogadro's number and forfeited the marks.

(c) Provide suggestions for improvement in relation to Teaching and Learning
Q 9.1 • Use definitions as they are from the Examination guidelines.
Q9.3 • The educators should do different examples of electrolysis, electroplating, refining of metals to expose learners to as many questions as possible.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
Q 9.4 • Incorrect conversion from hours to seconds. • Many learners wrote incorrect units, or they just left out the unit, meaning they do not know the unit. • Learners do not write all their steps; they just give the final answer. They keep everything in the calculator.
• The trend going forward appears to be integration of concepts from Physics with Chemistry. Give learners an opportunity to do questions that integrate the two topics in Physical Sciences. For example, one can ask questions on EMF and internal resistance in a galvanic cell. • Prepare questions on stoichiometry that involve electrochemical cells.
• When copying either the oxidation or reduction half-reaction from the Table of Standard Reduction Potentials, single arrows should be used to represent either the oxidation or reduction half-reaction.
• Teachers should provide learners with a summary of the types of prescribed electrolytic cells and thoroughly explain the functioning of each. This will enable learners to answer different questions on electrolytic cells with understanding rather than guessing.
• Teachers should prepare Grade 12 learners on how to answer questions that involve stoichiometry and should not assume that these calculations were taught in Grades 10 and 11. Learners should be made aware that stoichiometry is an integral part of Chemistry and could be assessed in any topic in the curriculum.