Province of the
EASTERN CAPE
EDUCATION

Iphondo leMpuma Kapa: Isebe leMfundo
Provinsie van die Oos Kaap: Department van Onderwys
Porafensie Ya Kapa Botjahabela: Lefapha la Thuto

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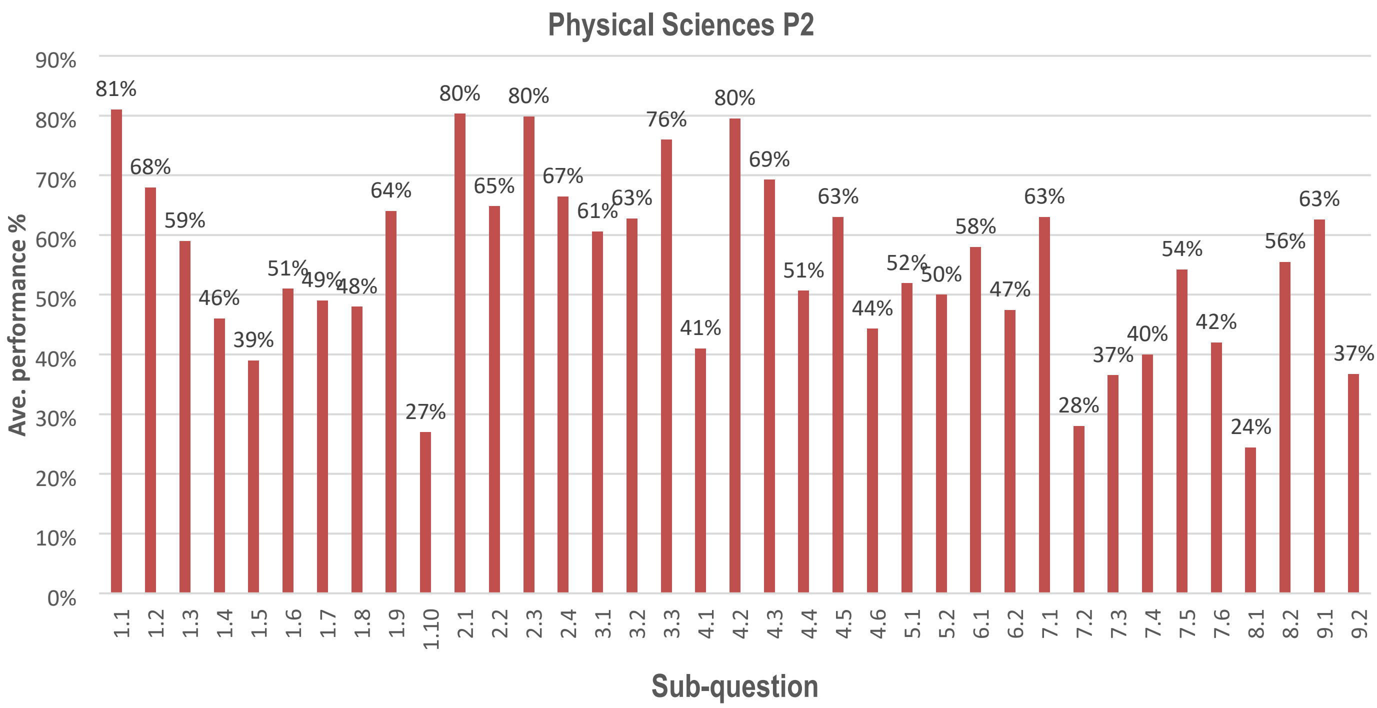
2024 NSC CHIEF MARKER'S REPORT

SUBJECT	**PHYSICAL SCIENCES**		
QUESTION PAPER	**2**		
DURATION OF QUESTION PAPER	**3 HOURS**		
PROVINCE	**EASTERN CAPE**		
NAME OF THE INTERNAL MODERATOR	**DAYIMANI, M. M.**		
NAME OF THE CHIEF MARKER	**VAN HEERDEN, L.**		
DATES OF MARKING	**2 – 13 DECEMBER 2024**		
HEAD OF EXAMINATION:	**MR. E. MABONA**		

SECTION 1: (General overview of Candidates Performance in the question paper as a whole)
The Rasch Analysis reveals that the candidates average score for the paper is 53% based on the 100 scripts sample. The population size has increased from 35 298 candidates in 2023 to 35 465 candidates in 2024 (0,47%).
The questions that scored the highest % are: Question 2 (Organic molecules: nomenclature and structures) with a score of 70%. Question 3 (Organic molecules: physical properties) with a score of 68%. Question 1 (Multiple choice questions) and Question 6 (Chemical Equilibrium) with a score of 53%. Question 4 (Organic molecules: reactions) with a score of 53%. Question 5 (Rates and Extent of reactions) with a score of 52%. *Poorly performed questions include:* Question 9 (Electrochemistry: Electrolytic cells) with a score of 47%. Question 7 (Acids and Bases) with a score of 46%. Question 8 (Electrochemistry: Galvanic cells) with a score of 35%.

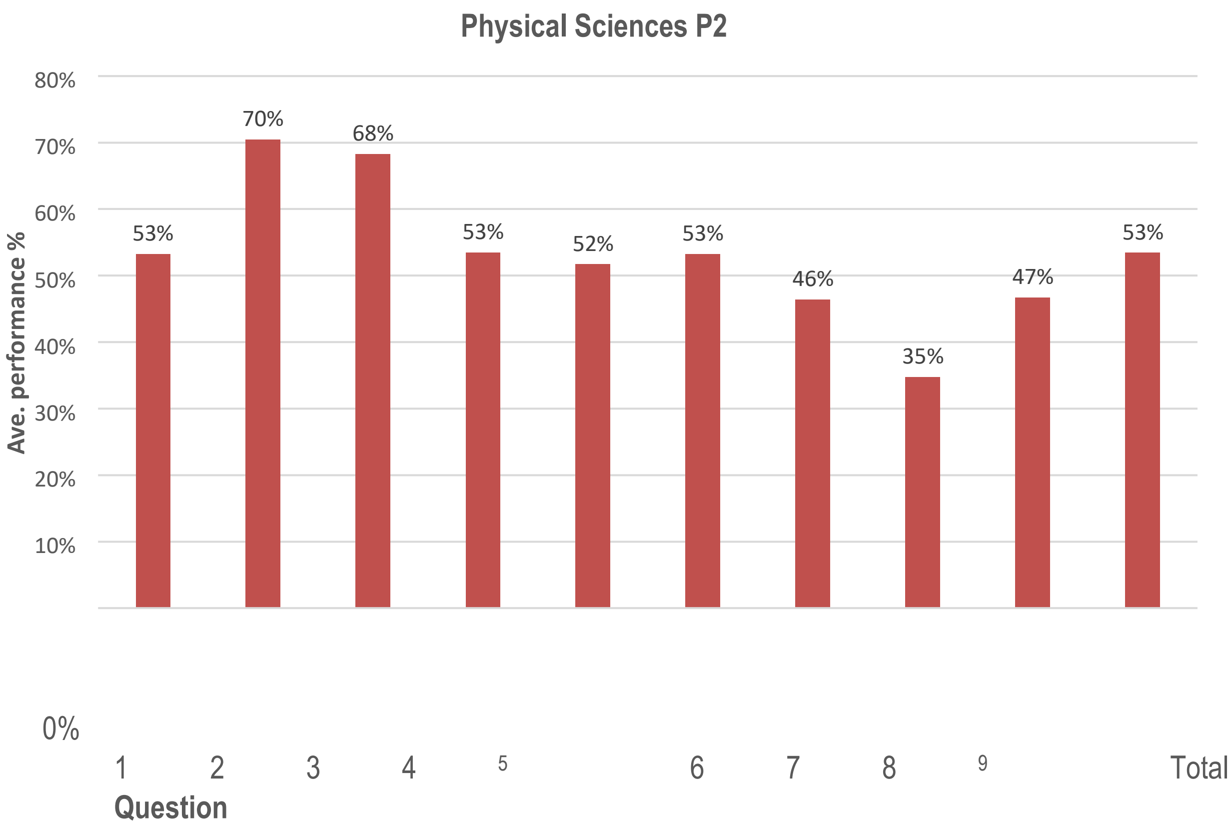
The following sub-questions were poorly answered by the candidates:
1.4 Energy and change (∆H / Activation energy of forward and reverse reactions) (46%).
1.5 Chemical equilibrium (Concentration at equilibrium) (39%).
1.7 Acids and Bases (Strength in relation to K_a and hydronium ion concentration (49%)
1.8 Acids and Bases (pH and equivalence point) (48%)
1.10 Electrochemistry (Electroplating) (27%)
4.1 Organic molecules (Definition of "cracking") (41%)
4.6 Organic molecules (Reactions using structural formulae) (44%0
6.2 Chemical Equilibrium (Kc calculation) (47%)
7.2 Acids and Bases (Writing conjugate acid) (28%)
7.3 Acids and Bases (Determining burette reading from given values) (37%)
7.4 Acids and Bases (Reason for suitable indicator) (40%)
7.6 Acids and Bases (Calculating water of crystallisation) (42%)
8.1 Electrochemistry (Using oxidation numbers and identifying the oxidising agent) (24%)
9.2 Electrochemistry (Electrolysis of NaCl) (37%)

The graph below shows the average percentage per sub-question in the 2024 NSC examination, based on information from the RASCH Analysis.



Sub-question	Topic	Ave. performance %
1.1	Organic molecules	81%
1.2	Organic molecules	68%
1.3	Organic molecules	59%
1.4	Energy & Change	46%
1.5	Chemical equilibrium	39%
1.6	Chemical equilibrium	51%
1.7	Acids & Bases	49%
1.8	Acids & Bases	48%
1.9	Electrochemical reactions	64%
1.10	Electrochemical reactions	27%
2.1	Organic molecules: nomenclature & structures	80%
2.2	Organic molecules: nomenclature & structures	65%
2.3	Organic molecules: nomenclature & structures	80%
2.4	Organic molecules: nomenclature & structures	67%
3.1	Organic molecules: physical properties	61%
3.2	Organic molecules: physical properties	63%
3.3	Organic molecules: physical properties	76%
4.1	Organic molecules: reactions	41%
4.2	Organic molecules: reactions	80%
4.3	Organic molecules: reactions	69%
4.4	Organic molecules: reactions	51%
4.5	Organic molecules: reactions	63%
4.6	Organic molecules: reactions	44%
5.1	Rate & extent of reactions	52%
5.2	Rate & extent of reactions	50%
6.1	Chemical equilibrium	58%
6.2	Chemical equilibrium	47%
7.1	Acids & Bases	63%
7.2	Acids & Bases	28%
7.3	Acids & Bases	37%
7.4	Acids & Bases	40%
7.5	Acids & Bases	54%
7.6	Acids & Bases	42%
8.1	Electrochemical reactions: Galvanic cells	24%
8.2	Electrochemical reactions: Galvanic cells	56%
9.1	Electrochemical reactions: Electrolytic cells	63%
9.2	Electrochemical reactions: Electrolytic cells	37%

The table and graph below show average percentage per question in the 2024 NSC examination, based on information from the RASCH Analysis.



Question	Topic	Ave. performance %
1	Multiple-choice Questions	53%
2	Organic Nomenclature and Structures	70%
3	Physical Properties of Organic Molecules	68%
4	Organic Reactions	53%
5	Rates and Extent of Reactions	52%
6	Chemical Equilibrium	53%

7	Acids and Bases	46%
8	Galvanic Cells	35%
9	Electrolytic Cells	47%
Total		**53%**

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 53%, lower than the 54% scored in 2023.
- Candidates only did well in sub-question 1.1, scoring 81%.
- Sub-questions poorly answered were 1.5 (39%), 1.7 (49%) and 1.10 (27%).

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

Q1.5

- Candidates were unable to use the mol ratio to determine the $[H_2] = [I_2]$ at equilibrium.

Q1.7

- Candidates could not link the hydronium ion concentration, the K_a value and the acid strength.

Q1.10

- Most candidates could not interpret this electrolytic cell. They could not identify the negative electrode, the ions which would undergo reduction and which electrode would be made of pure nickel.

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

Q1.5

- Educators must use balanced chemical equations to reinforce the concept of molar ratio, and how it affects number of moles as well as concentration of reactants and products.

Q1.7

- Educators must link the definitions of strong / weak acids to the hydronium ion concentration, the K_a value and the acid strength. The same must be done for bases.

Q1.10

- 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.

- Educators must guide and learners must practice the skill of eliminating incorrect answers.
- Assessing multiple choice questions on a regular basis in tests and in all topics.
- 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 / Educators should compile a booklet of multiplechoice questions arranged according to topics for schools. These questions can be used for weekly assessments.
- Learners must be taught not to leave multiple choice questions unanswered as there is no negative mark for an incorrect answer. They should rather take a guess if they do not know the answer.
- This section accounts for 13,3% of the total marks in the question paper and it is important for learners to practice the skill of answering multiple choice questions. These questions can be used as a quick test to see if learners know their theory without taking a lot of time to mark. Teachers should use them as continuous assessment or as spot tests once a topic is completed to test the learners' level of understanding. Learners must be guided to eliminate the wrong answers through regular practice and assessment. They should not just be given the answer, but should be provided with the reasoning behind the answers.

QUESTION 2:
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
Q2 • Was answered well. • The average score for question 2 was 70%.
• The sub-question with the lowest score was 2.2 (65%) – IUPAC naming. • Questions 2.1 and 2.3 were answered well; both scoring 80%.
(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
Q2.1.2 • Candidates could not identify the compound with the formyl group.
Q2.2.1 & Q2.2.2 • Incorrect numbering, no hyphens, or hyphens placed in the incorrect position. • Candidates wrote pent-2-yl or pentan-2-yne.
Q2.3 • Candidates could define "functional isomers", but some could not identify the functional isomers.
Q2.4.1 & 2.4.2 • Candidates could identify the catalyst and the type of reaction.
Q2.4.3 • Candidates could draw the functional group, but often had the chain length of the whole structure incorrect.
Q2.4.4 • Candidates left out the 1 in the name of 1-propanol or write prop-1-ol or prop-ol. Many left out the hyphen.
(c) Provide suggestions for improvement in relation to Teaching and Learning.

- IUPAC rules on nomenclature should be taught and practiced regularly when teaching IUPAC naming.
- Examination Guidelines 2021, Chief Marker's Report and the DBE Diagnostic report should be used WITH the CAPS document 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.
- For IUPAC naming, it is important to emphasise the following sequence:

1. Identify the longest carbon chain which gives the correct parent name.
2. Start numbering from the side giving the functional group the smallest number.
3. The functional group of haloalkanes do not get preference over the alkyl groups. Therefore, numbering should not necessarily start from the side closest to the halogen. Instead, numbering should start from the side giving substituents, halogen and alkyl, the lowest total number.
4. Substituents must be written in alphabetical order in IUPAC names, regardless of their position in the longest chain. Numbers of substituents indicate the position of the substituents in the longest chain.

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

- When drawing structural formulae, learners should be encouraged to count the number of bonds drawn around atoms to eliminate unnecessary errors. They need to be reminded that a carbon atom cannot have less than or more than 4 bonds around it.
- Frequent informal tests should be used to ensure that learners write definitions correctly. Often, learners write different interpretations of a definition, and they usually end up with incorrect or partially correct statements.
- Emphasis should be placed on the difference between molecular formulae, structural formulae and condensed structural formulae.
- Educators should apply different assessment methods, e.g. learners should be able to write the structural formula and condensed formula from the IUPAC name and vice versa.

QUESTION 3:
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
Q3 • Candidates recorded a score of 68%.
• Candidates performed the worst in Q3.1 (61%)
(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
Q3.1 • Candidates could not define “vapour pressure”, instead giving the definition of “boiling point”, left out key words or used “isolated system” instead of “closed system”.
Q3.2.2 • Candidates only compared A and B, not C. • Many candidates wrote their answer in terms of boiling point and vapour pressure and did not refer to structure (chain length), strength of intermolecular forces and energy required to overcome the forces.

Q3.3.1

- Most candidates could answer this question but could not fully explain the difference in vapour pressure between D and E (Q3.3.2).
- Many candidates did not explain using type of intermolecular forces, strength of intermolecular forces and energy required to overcome the forces. They only referred to vapour pressure and lost 3 marks.
- There are still candidates talking about “break the bonds” instead of “overcoming the forces”.
- Many candidates wrote “energy needed to overcome D is greater than energy needed to overcome E” not referring to bonds or intermolecular forces.
- Some candidates wrote “compound E has one site for hydrogen bonding” although E has no H-bonds.

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

- 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 area 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 intermolecular force in each compound.
  2. Compare the strength of the intermolecular forces.
  3. Compare the energy needed to overcome the intermolecular forces.

- Learners who are struggling to write the above in full sentences should use bullet points or even use a table to compare the physical properties of different compounds.

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

- When teaching this topic of physical properties, teachers must make sure that they revise Grade 11 intermolecular forces. Teacher should make sure that learners are able to identify types of intermolecular forces from different compounds (i.e. London forces, dipole-dipole forces, hydrogen bonds). Teachers must ensure that learners are able to compare the strength of intermolecular forces.
- Use of Examination Guidelines as a source of correct definitions for concepts cannot be over-emphasised. Often, learners write different interpretations of a definition, and they usually end up with incorrect or partially correct statements.
- There are centres that still use the phrase “break bonds” instead of “overcome intermolecular forces”. This must 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 4.2 scored the highest at 80% and question 4.1 showed the lowest performance at 41%

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

Q4.1

- Candidates could not define "cracking", not writing about "longer HYDROCARBON chains".
- Many referred to "longer organic compounds" or just "longer hydrocarbons to shorter "hydrocarbons".
- Those who referred to alkanes and alkenes as products, left out the hydrogen as a possible product.

Q4.2

- Candidates could identify the haloalkane as a primary haloalkane, but could not correctly give the reason.
- Many wrote "the haloalkane is bonded to one other carbon".
- Some candidates wrote -OH instead of -Br, giving the definition of a primary alcohol instead of a primary haloalkane.
- Many candidates wrote "It" is bonded to one other carbon, not naming the halogen.

Q4.3.1

- Most candidates drew the structural formula of compound T, instead of W.
- Some candidates did not draw the bonds between the carbon and hydrogen atoms, or did not draw all the hydrogen atoms.

Q4.3.2

- Many candidates wrote C_8H_{16}.
- Some candidates wrote the general formula of alkanes.

Q4.4.1

- Most candidates used HBr or Br instead of Br_2.
- Some candidates were writing "Bromide".

Q4.5

- Many candidates wrote "dehalogenation" and not "dehydrohalogenation".

Q4.6.1

- Candidates used Br_2 or H_2 instead of HBr, ending with an addition reaction where 2 Bratoms or 2 H-atoms are added to the structure.
- Many candidates drew 2 functional groups on the product (2 Br-atoms or a double bond and a Br-atom).
- Some candidates had the double bond of the reactant on the second C-atom, instead of the first C-atom.
- Candidates lost marks due to extra bonds on C-atoms (5 bonds) or lost marks due to having additional reactants or additional products.

Q4.6.2

- Most candidates did not add NaBr and H_2O as products.

Q4.6.3

- Some candidates wrote butane or butan-2-ene or butan-1-ene.

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

- 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.
- Educators and learners must be made aware that the functional groups of the different homologous series are in the CAPS document and the Examination guidelines.
- Emphasise the difference between the different types of isomers (chain, positional and functional).

(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 assist teachers in compiling summaries of the different types of reactions and their conditions to enable learners to memorise the required facts.
- Candidates used dehalohydrogenation / dehydrogenation / dehalogenation to describe the elimination reaction (dehydrohalogenation)
- Reaction conditions and inorganic reactants must also be emphasised. These are marks that learners can easily get, if taught and assessed well.

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 52%.

- Question 5.1 scored the highest at 52% and Q5.2 scored the lowest at 50%.

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

Q5.1.1

- Many candidates are still using "rate" and "per unit time" together as part of the definition or omitting the word "change" (Change in concentration per unit time).

Q5.1.2

- Many candidates converted the 5 minutes to seconds, although the unit was given as $dm^3.min^{-1}$.
- They substituted 24,5 $dm.mol^{-1}$ into the incorrect formula or used 22,4 $dm.mol^{-1}$, and not 24,5 $dm.mol^{-1}$.
- Many candidates use the ratio of HCl and Al instead of H_2 and Al.
- Candidates used (2X27=54) as the molar mass of Al.
- Most candidates did not calculate Δm, and stopped the calculation at m (Al) = 0,12g.
- Some candidates subtracted the initial mass from the calculated mass of Al.
- Some candidates added the initial mass of Al to the calculated mass of Al.

Q5.1.3

- Candidates referred to an increase in temperature.
- Most candidates explained in terms of an increase in reaction rate instead of a decrease in reaction rate.
- Some candidates wrote "since concentration is constant, the number of particles remain constant and hence reaction rate will be constant".
- Candidates wrote "particles have sufficient kinetic energy" instead of "more particles" or "increase in kinetic energy".
- Candidates left out "effective" when referring to collisions.

Q5.1.4

- For most candidates, graph A and B both started at the origin, but graph B ended higher than A or gradient was lower than graph A.
- Some candidates drew a Maxwell-Boltzman curve.

Q5.1.5

- Most candidates wrote "greater than" or "less than".
- Candidates did not know that powdered Al would produce the same volume of hydrogen gas.

Q5.2.1

- Some candidates mentioned “addition of a catalyst” as the change made in this question, they would therefore answer Q5.2.2 in terms of a catalyst being added. i.e activation energy decreases.
- Many candidates wrote “graph shifts to the right” instead of “the peak” or “Curve Y shifted to the right”.
- Candidates would leave out “sufficient” or “more”, stating that “particles have kinetic energy”.

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

- When teaching *reaction rates,* it has to be explained that rates can be calculated in terms of mass, volume, amount of substance (moles) and concentration. The units given for the reaction is a guide of whether or not the time needs to be converted.
- When doing *rates of reactions,* educators should do proper revision on basic stoichiometric calculations. Educators should be aware that the formula n = V/Vm can only be used for gases at STP.
- The difference between a Maxwell-Boltzman curve and a reaction rate graph must be emphasised.
- The factors affecting reaction rates must be taught using the Collision Theory along with the corresponding Maxwell-Boltzman curve and reaction rate graph.

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

- Educators should teach and assess learners on all the different types of graphs on a regular basis and how to interpret, analyse and answer questions based on graphs.
- Ensure that learners know the different factors affecting reaction rates and are this should be explained in terms of the Collision Theory. Use previous marking guidelines to assist learners on how to explain each factor in terms of the Collision Theory.
- Subject Advisors need to support educators with Stoichiometry and worksheets should be designed involving calculations. Learners have a poor understanding of Stoichiometry and are very uncertain when selecting formulae for a specific calculation.

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 53%.
• Question 6.1 scored the highest at 58% Question 6.2 showed the lowest performance at 47%.
(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
Q6.1.1 • Most candidates left out the word "rate" from this definition. • Some wrote "rate of reactants = rate of products". • Some wrote "both rates of forward and reverse reactions are constant". • Some candidates wrote "rate of change of the forward reaction". • Some candidates wrote "concentration of forward reaction = concentration of reverse reaction". • Many candidates use the word "reversible reaction" instead of "reverse reaction". • Some wrote "the rate of the forward reaction is in equilibrium with the reverse reaction".
6.1.4 • Candidates omitted the words "concentration" or "gases", just saying "graph decreases". Some candidates only referred to concentration of X and Z only, not referring to Y. • Some candidates could not differentiate between the reactants and products from the graph. • Many candidates responded by just saying "concentration decrease", not specifying which substances' concentration would be decreasing. • Some candidates gave the general statement, not applying it to the question.
Q6.1.5 • Candidates who were not able to distinguish between the reactants and the products wrote carbon dioxide. • Some candidates wrote CO – carbon dioxide or CO_2 – carbon monoxide.
Q6.1.6 Candidates responded by stating "reverse reaction is favoured", not giving any reasoning.
Q6.1.8 • Many candidates were stating Le Chatelier's principle, not applying the principle to explain the answer to Q6.1.7. • Some candidates wrote "increase in temperature favours the forward reaction", or

"reverse reaction is favoured", not identifying the reaction as endo- or exothermic.
Q6.2 • Candidates would add the products' AND reactants' number of moles OR subtract the number of moles of both the products and reactants instead of subtracting the number of moles of the reactants and adding the number of moles of the products. • Many candidates used 0 as the initial number of moles of the products. Many candidates used 0 as the change in the number of moles of reactants and products. • Many candidates did not use the given values for this calculation, they inserted their own values in the Kc table. • Some candidates inserted their own values for the change in number of moles (not x). • Some candidates used initial number of moles to calculate the equilibrium concentration, not the moles at equilibrium. • Many candidates did not write a Kc expression, only Kc = 4. • Many candidates calculated the concentration of CO_2 instead of CO. • Many candidates inverted the Kc expression. • Most candidates omitted the H_2O from the Kc expression, even though it as a gas. • Many candidates used c = m/MV to calculate the mass of CO. • Most learners could not calculate the unknown value of x. • Some learners calculated the x and stopped there, they did not continue to calculate the mass of CO. • Many candidates wrote Kc = [products]/[reactants] or Kc = [reactants]/[products]
(c) Provide suggestions for improvement in relation to Teaching and Learning.

- Ensure learners understand and can interpret the various graphs (rate vs time and concentration vs time) that relate to changes in equilibrium conditions. Learners must know how to explain the changes happening to the equilibrium position, in words.
- Explain to learners why solids and pure liquids should not be included in Kc expressions and expose them to enough exercises to practice expressions for reactions where reactants and products are in different phases.
- Avoid using $K_c = \frac{[products]}{[reactants]}$ in class. This creates the impression that it is the correct Kc expression.
- Educators should use the Examination guidelines for definitions. Different textbooks have different definitions, hence educators must stop using textbooks for definitions.
- Educators should assess learners in ALL the factors affecting chemical equilibrium.
- When explaining answers in terms of Le Chatelier's principle, the following guide will assist:

  1. Mention the disturbance.
  2. State that the system will act to oppose this disturbance.
  3. State which reaction (forward or reverse) will be favoured when opposing the disturbance.
  4. Mention the effect on, for example, the number of moles of product / or reactant.

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

- 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.
- Teachers should avoid using $K_c = \frac{[products]}{[reactants]}$ in class. Instead, use chemical equations to teach the writing of Kc expressions.
- Educators and learners need to be made aware of the difference between STATING Le Chatelier's principle and APPLYING Le Chatelier's principle.

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 46%
• Question 7.1 scored the highest at 63% while question 7.2 scored the lowest performance at 28%.
(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
Q7.1 • Candidates wrote incomplete definitions, omitting some keywords "in water", "in solution", "low concentration". • Candidates cannot differentiate between "dissociates" and "dissolves". • Some candidates use "hydronium ions" or "hydroxyl ion" or "hydrogen ion" instead of "hydroxide ion". • Many candidates who wrote the formula for the hydroxide ion did not write the negative charge (OH^-), or wrote OH^+ or HO^-. • Some candidates inserted the word acid into the definition of "weak base".

Q7.2

- Many candidates omitted the charges when writing the formula of the conjugate acid.
- Many candidates tried to write a chemical equation, instead of just writing the formula of the conjugate acid.
- Candidates wrote $K_2CO_3^{2-}$ or KCO_3^{2-}

Q7.3.1

- Many candidates wrote – 26,55, incorrectly subtracting the volumes.
- Other candidates wrote 13,55.

Q7.3.2

- Many candidates also subtracted the two values.

Q7.4

- Many candidates wrote the pH range of methyl orange incorrectly
- Most candidates only addressed the first bullet in the marking guideline.
- Many learners said the pH or reaction or titration is acidic and did not address the colour change of the methyl orange.
- Many candidates said "it is acidic".

Q7.5

- Most candidates did not use the average volume.
- Some candidates used the dilution formula.
- Some candidates use correct formula, but invert substitution or some candidates invert the formula but do not invert the substitution.
- Most candidates incorrectly converted the volume in c= n/V
- Many candidates used the total volumes for the acid (50) and the base (40,2).

Q7.6

- Most candidates used the incorrect formula or molar volume formula or copied the formula incorrectly from the formula sheet
- Most candidates could not link Q7.5 to Q7.6 and tried to calculate a new concentration for K_2CO_3
- Some candidates guessed the correct answer of x = 2; the calculation does not support the answer
- Incorrect calculation of molar mass; multiplication of elements instead of addition
- Many candidates did not subtract the mass values of water

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

- Differences between strong /weak acids or bases should be taught. Use Examination guidelines for definitions.
- Do exercises that will afford learners the opportunity to practice stoichiometric calculations.
- Educators should emphasise the importance of units. There is a general rule what states, no unit = no mark for the 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.

- Ensure that Stoichiometric calculations are properly taught in Grades 10 and 11.
- Rounding off should only be done at the final answer of a 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 35%, the lowest of all the questions in this question paper.

- Question 8.2 scored the highest at 56% while Q8.2showed the lowest performance at 24%.

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

Q8.1.1

- Most candidates could not use oxidation numbers to show that it is a redox reaction

Q8.1.3 and Q8.1.4

- Most candidates were struggling to use the Table of Standard Reduction Potentials

Q8.2.1

- Many candidates were able to write the balanced net ionic equation from the cell notation

Q8.2.2

- Most candidates were able to answer this question

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

- Educators must use the Table of Standard Reduction Potentials when teaching redox reactions.
- They must show learners where to 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 teaching the table in Grade 11, when teaching the redox chapter.
- Educators must 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.
- When teaching redox reactions, teachers should start with direct electron transfer and from there go over to galvanic cells which are the indirect transfer of electrons.
- When the strengths of oxidising agents are compared, ions must be compared with ions and not atoms. Similarly, when the strengths of reducing agents are compared, learners should compare the atoms with atoms and not with ions.

(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 must 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 47%.
• Question 9.1 scored the highest at 63% while Q9.2 showed the lowest performance at 37%.
(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
Q9.1.1 • Many candidates omitted the negative sign in "-0,13" giving them a positive answer.
Q9.2.1 • Many candidates left out the keywords: "solution", "in water", "conducts". • Many candidates defined "electrolytic cell" or "electrolysis" or gave energy conversions.
Q9.2.2 • Most candidates could not write the oxidation half reaction. • Some learners omitted the coefficient, copying incorrectly from the formula sheet.
Q9.2.3 • Very few candidates could identify the products formed at electrode Q.
Q9.2.4 • Most candidates were struggling to use the Table of Standard Reduction Potentials to explain their answer to Q9.2.3.
(c) Provide suggestions for improvement in relation to Teaching and Learning.
• Use definitions that are from the Examination guidelines. • Educators should do different examples of electrolysis, electroplating and 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.

• 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. • The difference between the definitions of "electrolysis" and "electrolyte" should be emphasised. An *electrolyte* is a solution that conducts electricity through the movement of ions while *electrolysis* is a process during which electrical energy is converted to chemical energy.
• Learners must be taught how to select half-reactions. Teaching of the Table of Standard Reduction Potentials is vital, and learners must be encouraged to refer to the table to avoid the mistakes of unbalanced equations when writing the half-reactions. • More assessments must be given. • The required time allocated on the ATP must be used when teaching this topic. • The difference between galvanic cells and electrolytic cells must be emphasised. It is recommended that the construction and demonstration of both cells should be an integral part of teaching electrochemical cells, where the energy conversion will be visible to candidates.