Province of the
EASTERN CAPE
EDUCATION

EXAMINATIONS AND ASSESSMENT CHIEF DIRECTORATE
Home of Examinations and Assessment, Zone 6, Zwelitsha, 5600
REPUBLIC OF SOUTH AFRICA, Website: www.ecdoe.gov.za

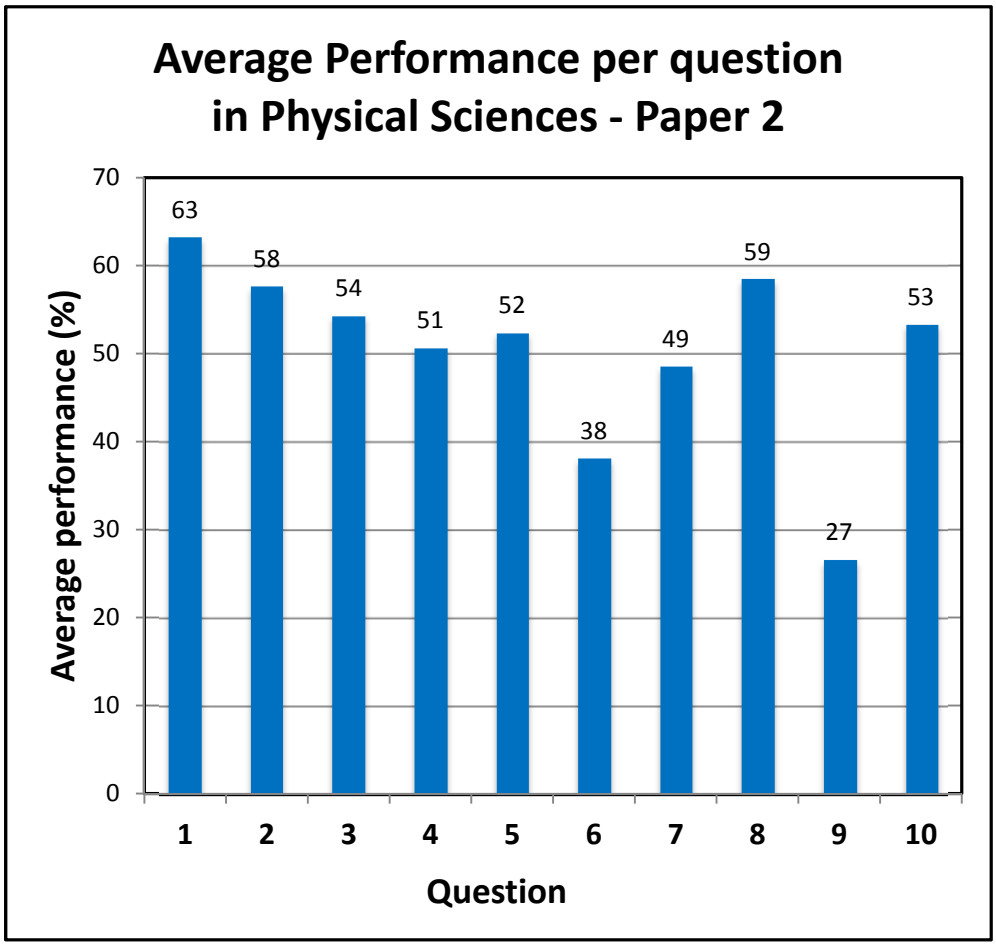
2019 NSC CHIEF MARKER'S REPORT

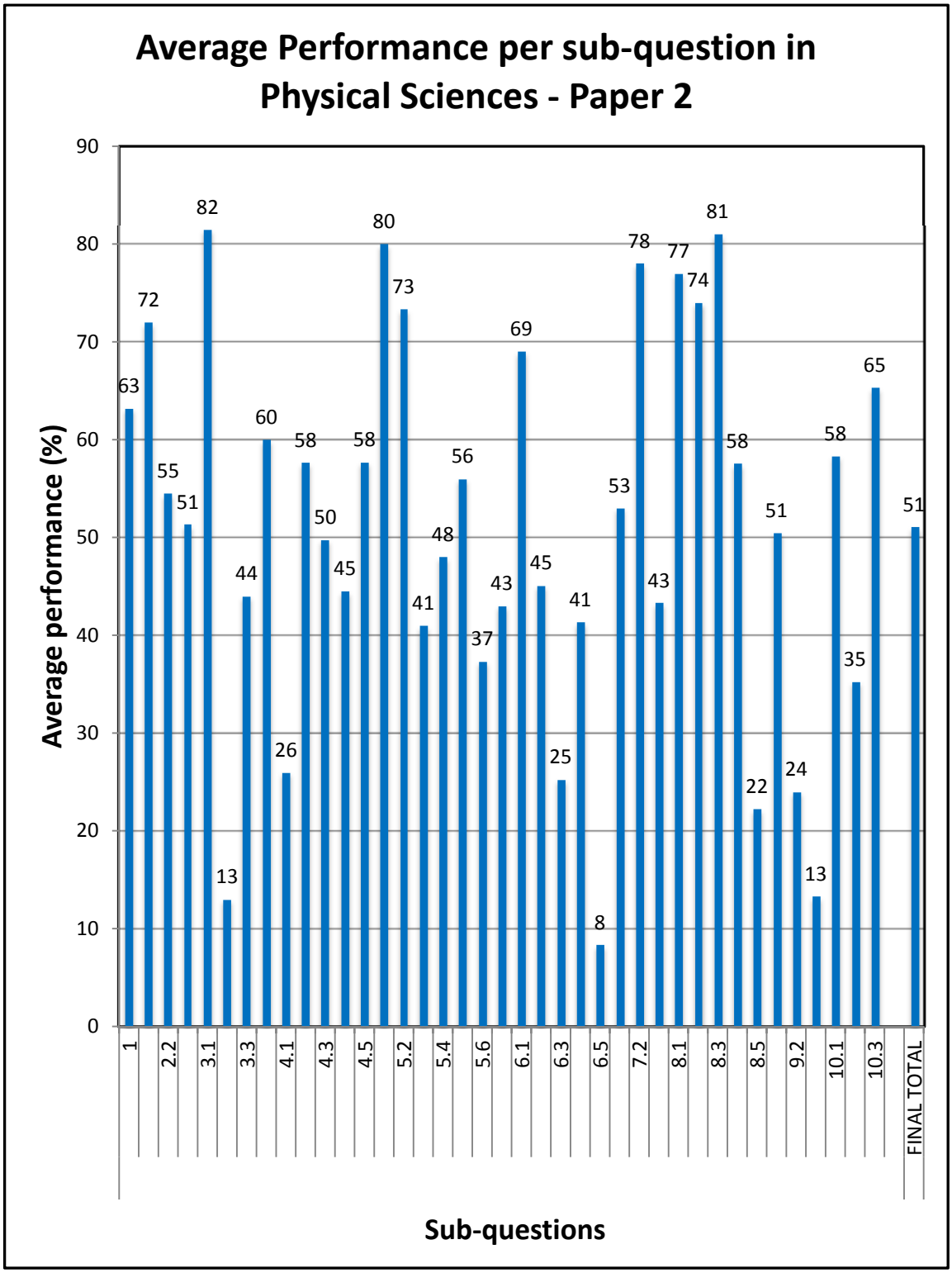
SUBJECT:	**PHYSICAL SCIENCES**
PAPER:	**2**
DURATION OF PAPER:	**3 HOURS**
DATES OF MARKING:	**03-12-2019 TILL 14-12-2019**

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

- The candidates' average score for the paper is **51%** (*based on the 100 scripts sample*).
- In the CONTEXTUAL questions; **Question 8** had a better performance with average score of **59%** followed by **Question 2, 5, and 4** in that order.
- **Question 9** had the worst learner performance with a score of **27%**. Even strong candidates were only scoring *2 out the 8* marks in this question.
- The topics CHEMICAL EQUILIBRIUM and ACIDS/ BASES were also poorly answered with scores of **38%** and **49%** respectively.
- Candidates performed relatively well in the MULTIPLE CHOICE QUESTION - question ONE had a score of **63%**.

QUESTION NUMBER	TOPICS	AVERAGE %
1	Matter and materials ,Chemical change and chemical systems	63
2	Organic molecules	58
3	Organic molecules-physical properties	54
4	Organic molecules-organic reactions	51
5	Reaction rates	52
6	Chemical equilibrium	38
7	Acids and bases	49
8	Galvanic cell	59
9	Electrolytic cell	27
10	Fertilisers	53





I recommend that a certain percentage of teachers who have marked PAPER 1 be APPOINTED to mark PAPER 2. *This will assist the system in making sure that our teachers are ware of developments in each paper. Teachers will not develop if allowed to stay in their comfort zones only.*

SECTION 2:

Comment on candidates' performance in individual questions

(It is expected that a comment will be provided for each question on a separate sheet).

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 **63 %** - the BEST SCORE of all the questions.
Most candidates including low performing candidates managed to obtain marks in the EASY QUESTIONS namely 1.1 , 1.2 , 1.3 ,1.9 and 1.10
Sub questions 1.4, 1.7, 1.8 and 1.9 were POORLY answered.

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
Questions 1.4, 1.7, 1.8 and 1.9 were POORLY answered. These questions were of a higher order of difficulty.
Question 1.4 was CHALLENGING if candidates did not draw the potential energy diagram.
Question 1.7 candidates could not establish the relationship between pH and concentration of hydronium ions
Questions 1.8 and 1.9 candidates got CONFUSED with the terms oxidation, reduction, oxidising agent, reducing agents, anode and cathode. Candidates could not decide which one is positive or negative in an electrolytic cell.

(c) Provide suggestions for improvement in relation to Teaching and Learning
• The answering of multiple-choice questions is a SKILL that needs to be developed. Candidates must be guided to eliminate the wrong answers through regular practice and assessment. Multiple choices must be assessed on a regular basis on all topics covered.
• Subject advisors can compile a workbook containing multiple choice questions from previous years, per topic, and distribute to schools for educators and candidates to use effectively.
• More practice on multiple choice questions. Include multiple choice questions in short tests as well.
• Assist learners in remembering terms associated with the anode-then those that are associated with cathode are the opposites.
Learners must understand that oxida**tion** and reduc**tion** are REACTIONS while oxidis**ing agents** and reduc**ing agents** are SUBSTANCES.
Rather avoid using the words oxidized and reduced as you are adding more confusing vocabulary – LIMIT TERMINOLOGY to oxidation, reduction, reducing agent and oxidising agents

QUESTION 2

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

The average score for this question was **58 %**. Candidates' performance in this question was MODERATE.

Question 2.1 scored the highest at 72 % while 2.3 showed the lowest performance at 51%.

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

2.1.1 Candidates did well in this question but some wrote the name of the homologous series instead of the general formula. Candidates also confused the different types of formulae used in organic chemistry namely empirical, molecular, structural and condensed structural formulae. Some candidates gave the structural formula for the functional group in place of the general formula.

2.1.2 The question was generally answered well as most candidates could draw the structural formula. Candidates lost marks for adding an extra bond, omitting a hydrogen atom or mixing the structural formula with condensed structural formulae.

2.2.1 The definition of positional isomer was incomplete –learners would get the first part correct but miss the second part for example some candidates wrote "Compounds with the same molecular formula but **different structural formulae.**" The bold part was not correct.

Most candidates wrote that an isomer has the same molecular mass, but then lost a mark for the description of the different positions of the side chain/ functional group/ substituent. Other candidates also got confused between same general formula and same molecular mass.

2.2.2 Common errors made by candidates in this question was that the candidates omitted the "an" in the IUPAC name or they got the position of the functional group wrong for example pent-3-one.

Candidates tried to write the IUPAC name of the given compound in place of the positional isomer. The concept of functional and positional isomer is not understood by many candidates. The common answer for 2.2.2. was "pent-2-one"

2.2.3 The structural formula was answered well, but common mistakes like omitting a bond or a hydrogen atom is still common errors made by candidates.

2.3.1 Most candidates could identify the tertiary alcohol, but their reasoning was wrong, for example the hydroxyl group (OH) or the alcohol is bonded to three carbon atoms.

2.3.2 The biggest mistake here is that candidates get confused on how to write the IUPAC name. Candidates omit the "an" for butan-2-ol. Other errors made by candidates were that they forgot to add the hyphens in the IUPAC naming.

In 2.3.2 the common incorrect answer was 2-methyl but-2-ol

2.3.3 Similar to question 2.3.2 candidates get confused on how to write the IUPAC name, here candidates added an extra "an" for butan-2-ene. Other errors made by candidates were that they forgot to add the hyphens in the IUPAC naming.

(c) Provide suggestions for improvement in relation to Teaching and Learning
• Rules on nomenclature should be taught and practiced very well.
• Thorough revision must be done before or after the trial examination to recap important aspects of organic chemistry as this topic was done during term 1 and candidates tends to forget the basics of organic chemistry.
• When teaching IUPAC naming encourage learners to use the correct method for IUPAC naming, for example Pentan-3-one instead of 3-Pentanone.
• Examination Guidelines and the Chief Markers Report should be used WITH the CAPS documents when teaching (so that educators can see the depth/extent of a specific topic).
• Examination Guidelines should be used for definitions.
• Administer exercises that address the different types of formulae used in organic chemistry especially conversion from condensed structural formulae to structural formula.
• Develop exercises that address the different type of isomers –definitions, naming and structural formulae

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
• Carelessness – 5 bonds per C-atom or bonds and/ or hydrogen atoms omitted. In some candidates' responses the functional groups are not known by learners.
• Structural vs Molecular vs Condensed formulae should be taught and applied so that learners know the difference and be able to apply it correctly.
• More time must be given to candidates to practice drawing structural formulae of organic compounds.
• EMPHASIZE to candidates that a carbon atom can only make a maximum of 4 bonds.
• Candidates refer to the OH group as the functional group of alcohols when explaining tertiary alcohols. Candidates must be made aware that it is the carbon atom that is attached to the OH group that is connected to three other carbon atoms.
• It is advisable that learners practice writing out the position of the functional group before the parent name e.eg for butan-2–ol rather write 2 –butanol to avoid leaving out the "an".

QUESTION 3
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
The average score for this question was **54 %**. Candidates' performance in this question was MODERATE.
Sub question 3.1 scored the highest at 82 % while 3.2 showed the lowest performance at 13%.

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
3.1 Well answered, most candidates got the definition correct, but many candidates referred to boiling point as a point and not as the temperature for example; Boiling point is the "point" where vapour pressure is equal to atmospheric pressure instead of saying the "temperature". Candidates lost a mark for the omission of the word temperature.
3.2 Most candidates FAILED to answer this question correctly. Candidates wrote that it was a fair comparison because compounds Q, R and S all belonged to the same Homologous series and/ or they have the same intermolecular forces/ same London forces. Very few candidates obtained marks in 3.2. The most common answer was alkanes-which was not complete and therefore incorrect.
3.3 Question 3.3 was a HIGHER ORDER question requiring learners to make comparisons between surface area, intermolecular forces and energy in three organic compounds **P**, **Q** and **S**. Very few candidates compared all three compounds with one another. They either compared R with Q, or R with S or S with Q. Candidates also struggled to give the whole explanation as there was no guidance given to candidates in term of surface area, intermolecular forces and energy. There is also a lot of confusion with candidates in terms of intermolecular forces and intramolecular bonds.
3.4.1 The candidates had an option between P (an aldehyde) and T (and alcohol). If candidates did not know the difference between the strengths of the intermolecular forces they would have chosen the wrong option.
3.4.2 Candidates that got question 3.4.1 correct, generally also gained full marks in this question. Candidates were guided on what is needed in their explanation and therefore many candidates gave a complete explanation. Those candidates that lost marks in this question lost the marks because they do not know the difference between the different types of intermolecular forces. Candidates that LOST MARKS also referred to the intermolecular forces as bonds and stating that more energy is needed to break the bonds.

(c) Provide suggestions for improvement in relation to Teaching and Learning
• Suggestions for improvement in respect to teaching and learning: Revision. Repetition, repetition, repetition. Past question papers (Guide candidates on how to answer questions, work previous question papers into lesson planning and homework exercises, and guide learners step-by-step on how to answer specific questions).
• Examination Guidelines and the Chief Markers Report should be used WITH the CAPS documents when teaching (so that educators can see the depth/extent of a specific topic).
• Examination Guidelines should be used for definitions.
• Structural vs Molecular vs Condensed formulae should be taught and applied so that learners know the difference and be able to apply it correctly.
• Relationships between physical properties and chain length/homogenous series should be re-enforced. Learners must be given exercises questions on how to identify the variable being investigated.
• Where learners compare two chain isomers. Extend to comparison of three chain isomers .Learners must know that only London forces are affected by chain length. When comparing three chain isomers it is helpful to compare the two extremes for example Q has the smallest surface and S the largest surface area. In this case you do not need to mention the third compound as it will by implication be in the middle.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
• To assist learners to know what forces are in which compounds It helps to know that all the homologous series have London forces. If there is oxygen or a halogen atom there will also be dipole-dipole forces. But in alcohols and carboxylic acids there is special type of dipole-dipole forces namely hydrogen bonds-the strongest of all forces between molecules. Carboxylic acids have the strongest hydrogen bonds as they have twos sites for hydrogen bonding hence higher boiling points/ melting points and lower vapour pressure for carboxylic acids.

QUESTION 4
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
The average score for this question was **51 %**. Candidates' performance in this question was MODERATE.
Sub question 4.2 and 4.5 scored the highest at 58 % while 4.1 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.
4.1 Candidates did not know or realised that compound A was a saturated compound, and identified it wrongly. This affected their marks for the rest of question 4. Question 4.1 was a challenge to most candidates as they had to work backwards from products back to the reactant
4.3.1 A common mistake candidates made in this question was that they wrote the standard conditions of a galvanic cell for the reaction conditions for a substitution reaction of haloalkanes with a strong diluted base and mild heat. In 4.3.1 candidates who committed to say "strong heat" lost a mark .Writing only heat was a sufficient response.
4.3.2 General responses to this question wereprop-1-ol, propan-1-ol/ prop-1-ol and propa-1-nol as the IUPAC name for propan-1-ol. Many candidates also omitted the number, writing only propanol. A common response for 4.3.2 was prop-1-ol which was incorrect as the "ol" is omitted.
4.4 Many candidates wrote the structure of an alkane instead of the structure for an alcohol. Candidates also do not know the difference between a major and a minor product. In Question 4.4 some candidates did not apply the rule for writing the major product instead they wrote the structural formula of the minor product (propan-1ol)-they lost a mark.
4.5.1 Candidates who did not know the process of esterification gave the structural formula of a carboxylic acid instead of an ester.

(c) Provide suggestions for improvement in relation to Teaching and Learning
• Teachers must use wording cautiously when explaining definition and concepts. EMPHASIS MUST BE PLACED ON MEMORISING DEFINITIONS.
• Learners should understand the difference between general formula, structural formula and molecular formula. Teachers need to teach these concepts properly.
• Structural vs Molecular vs Condensed formulae should be taught and applied so that learners know the difference and be able to apply it correctly.
• Develop exercises where learners work backwards that is given the product and one

reagent be able to find one reactant.
• Develop exercises that allow learners to identify type of organic reaction based on reactants used/products formed/reaction conditions.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
• It is advisable that there should in-service training on organic reactions.

QUESTION 5
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
The average score for this question was **52 %**. Candidates' performance in this question was MODERATE.
Sub question 5.1 scored the highest at 80 % while 5.6 showed the lowest performance at 37 %.

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
5.1 Question was well answered but some candidates did not know that $\Delta H < 0$ represents and exothermic reaction.
5.2 The calculation was well answered but common errors candidates made was that they did not calculate a change in the mass.
5.3 The challenge that a lot of candidates faced in this question was reading and interpreting the given information. Many candidates could not calculate 40 % of 2 g which were the starting point for this calculation. Then candidates also used the wrong ratio for example they used the ratio between HCl and CO_2 instead of the ratio for $CaCO_3$ and CO_2.
5.4 Candidates could not identify the controlled variable and many candidates used $1/\Delta t$ and other candidates also stated surface area and temperature. Some candidates could identify the controlled variable as mass, but they were not specific in stating that it is the mass of the antacid tablet.
5.5 Many candidates could identify the independent and the dependent variables, but candidates struggled identifying $1/\Delta t$ as the rate and then drawing a conclusion that as the temperature increase, the rate of the reaction will also increase. Some candidates also wrote the conclusion to be an inverse proportionality.
5.6 Candidates left out key terms like increase in the average kinetic energy, more molecules and more effective collisions PER UNIT TIME. The explanation in terms of collision theory was poorly done as candidates omitted important words for example omission of the words "more particles" have $E_k \geq E_a$..' learners would write $E_k > E_a$ only. Other candidates wrote "Effective collision per unit time omitting the "more" - this is not acceptable.
5.7 Many candidates started the graph with a horizontal line and then showed an upwards curve. Candidates also did not follow the instructions of the question by first redrawing the given graph and then draw a second graph and labelling it Y.

(c) Provide suggestions for improvement in relation to Teaching and Learning
• Teachers must use wording cautiously when explaining definition and concepts.
• Emphasis must be placed on MEMORISING DEFINITIONS. Educators can give small quizzes in class or small tests so that the candidate can familiarise themselves with the correct wording of the definitions as stated in the Examination Guidelines ONLY.
• Teachers should stay away from "NONSPECIFIC" terms like "speed" and "faster".
• Teachers to revise factors affecting rates using different practical examples in their explanation.
• Old examination papers should be used so that candidates can get enough exposure in stoichiometric calculations, a candidate need to understand how to apply his knowledge of quantitative aspects of chemical change to any other topic in the grade 12 CAPS syllabus.
• Examination Guidelines and the Chief Markers Report should be used daily in lesson planning.
• Encourage candidates to use Examination Guidelines to study their definitions.
• You-tube videos and Phet simulations can also be used to make teaching and learning more interactive and interesting.
• Teach lessons that molar volume equation is only used for GASES at STP.
• When doing rates have exercises that address stoichiometric calculations on rates of reaction.
• For HYPOTHESIS testing start with investigations and assessment of investigations in earlier grades to assist learners with concepts like independent/dependent/controlled variables/relationships/investigative questions and hypothesis.
• For question 5.3 STOICHIOMETRY MUST BE THOROUGHLY COVERED IN GRADE 11.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
• Some candidates still use direct proportion for any two quantities that increase together (5.5)-this could be coming from bad teaching. Direct proportion has a specific meaning in science –teachers must REFRAIN from using the concept 'direct proportion" loosely".
• Doing practical work is a key strategy to teach reaction rates and to address hypothesis testing

QUESTION 6
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
The average score for this question was **38 %**. Candidates' performance in this question was POOR.
Sub question 6.1 scored the highest at 69 % while 6.5 showed the lowest performance at 8 %

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
6.1 The definition for chemical equilibrium was well answered but the candidates who lost marks here lost it because of the omission of the word rate in their definition. Candidates who omitted the word "rate" lost all the 2 marks.
6.2.1 Candidates used the given mass as the initial mole value and also divided the given concentration by 3 instead of multiplying it by 3 to get the number of moles of CO_2 at equilibrium. Candidates also lost marks for including the concentration of C(s) in the Kc expression and for writing the concentrations for the Kc expression using round brackets instead of block brackets.
6.2.2 This question was poorly answered; candidates did not use the mole ratio between CO_2 and C for the number of moles used to determine the minimum mass of C that must be present in the container. The majority of the candidates only scored one mark for the substitution of the molar mass (12) for C.
6.3.2 Many candidates did not explain their answer by making use of Le Chatelier's Principle instead they stated the principle. Candidates also do not choose between increase, decrease or remains the same and therefore forfeit all the marks for their explanation. Candidates did not get marks for explaining without indicating what happens to the amount of CO.
6.4.1 In question 6.4.1 there was incomplete explanations. Most candidates could identify the reaction as an exothermic reaction, but they did not use Le Chatelier's Principle to explain their answer.
6.4.2 This was the worst answered question in the whole question paper. Candidates had no idea how to determine the temperature T. Some candidates used mass percentages while others tried to answer the question by comparing percentage ratios to mole ratios. Many candidates simply just left out this question. It was new type of question which was of a higher order and only a few candidates managed to get it right.

(c) Provide suggestions for improvement in relation to Teaching and Learning
• Each learner should be provided with an Examination Guideline that must be used in the classroom and studying.
• More focus on the different factors and how they impact on a reaction in equilibrium.
• More examples from past year papers.
• Teachers must be careful using their " own words in definitions"-use exclusively what comes from exam guidelines.
• In question 6.4.1 Teachers should start with basics on Kc calculations like writing Kc expressions, substituting equilibrium concentrations into the expression etc. before introducing learners to the table as strategy to solve Kc problems
• Writing down the Kc expression, substituting into the expression (if possible) and solve (if there is one unknown). Convert mass to moles and concentration to moles. Draw and complete a table.
• Develop exercises on writing down the expression for the equilibrium constant for different equilibrium reactions - 8 at least.
• Teachers MUST ASSIST learners with explanations for example for explanations you need to (1) State what change is opposed (2) Rule (c/T) (3) Which reaction is favoured -reverse reaction OR forward reaction. Learners do not need to re-state Le Chatelier's principle
• Develop exercises on effect of temperature on Kc. Remember Kc changes the same way products change that is if amount of products increase Kc also increases

(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 follow a set of steps in Kc calculations before drawing the table for example
• When explaining using Le Chatelier learners need not re-state the Principle. They indicate the change that is opposed, state the rule (for c/T) and then write down which reaction is favoured forward or reverse. A lot of learners, some from well performing centers restate the Principle and there are no marks for that.

QUESTION 7

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

The average score for this question was **49 %**. Candidates' performance in this question was MODERATE.

Sub question 7.2 scored the highest at 78 % while 7.3 showed the lowest performance at 43 %.

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

7.1 Many candidates could identify HBr as a strong acid, but some learners could not give the correct reason for their answer. General wrong answers given by candidates for why this was a strong acid were that it dissociates completely, or the Ka value is very big. Candidates do not know their definition for a strong acid and applying Ka to the definition.

7.2 Question was well answered but some candidates forfeited a mark for either omitting the negative sign on Br^- or for identifying H_30^+ as a base.

Question 7.3 was a higher order question .Some candidates could not understand the question as there were many steps to follow to reach the answer as it of a higher cognitive ability.

Teachers introduce learners to the formula CaVa/CbVb when dealing with acids and bases. Unfortunately learners apply this formula to any calculation that deals with acids and bases even it does not apply—product of bad teaching. Learners are not encouraged to think/analyse the problem .Learners who could use n =cV to find moles and then use ratios lost a lot of marks in this question.

7.3.1 Candidates struggled to interpret the question and the use of two equations confused a lot of the candidates. Candidates used inappropriate or wrong formulas for the given information and also did not use the information sheet to write down the correct given formula for pH. Calculating using mole ratios is still a big problem for a number of candidates.

7.3.2 Candidates did not know how to calculate the moles for $Zn(OH)_2$ that reacted with HBr, they used the moles that reacted with NaOH only to find the initial mass of $Zn(OH)_2$. Most candidates did not subtract the excess mole from the initial moles to get the number of moles that reacted for the HBr.

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

- Acids and basis must be TAUGHT PROPERLY IN GRADE 11 and enough time must be allocated in grades 11 and 12 so that candidates fully understand the theory and concepts of acids and basis as prescribed in the CAPS syllabus.

• Continue in Grade 11 = revision and consolidation plus additional stoichiometry, THEN proper teaching and revision (consolidation) in Grade 12.
• The preparation of a standard solution, dilution of substances and titration practical's must be done in class so that candidates can gain a comprehensive understanding of the theory and experiments.
• Use Examination Guidelines and CAPS documents for definitions and thorough teaching.
• Each learner from grade 10 to 12 should have a copy of the Examination Guidelines which include content coverage, definitions and data sheets needed.
• Candidates should know how to use the formula sheet. This should be introduced from Grade 10 and not just be given in the examination. Each learner must have his/her own copy of the formula sheet in their books so that they can get used to it.
• Candidates must be made aware on how marks are awarded for a calculation in Physical Sciences *Formula (Correctly written or copied from the information sheet) *Substitution *Answer and SI-unit Educators must emphasize in class: "NO UNIT, NO MARK!".

- FOR STOICHIOMETRIC CALCULATIONS LEARNERS MUST BE TAUGHT ONE METHOD THAT ALWAYS WORKS IN EVERY SITUATION. For example why must learners when dealing with acids and bases in grade 12 find a new formula for titration caV/cb.Vb = na/nb. To learners this is totally new and they throw away all what has been taught earlier on stoichiometry and yet things work the same way – there is no need for a new formula. Learners need to read the question and apply n= cV and use ratios and calculate the unknown. The association of the caVa/cbVb = na/nb with acids and bases limits learner's thinking-immediately they see a calculation involving acids and bases they plug in that formula even if it does not apply-very unfortunate.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
• Candidates must be told to revise and practice quantitative aspects of chemical change and stoichiometric calculations from grades 10 and 11, and they must also practice how to convert units into SI-units. Additional attention must be given to this when teaching acids and basis.
• Use Examination Guidelines and CAPS document when teaching.
• The questions in the textbooks only test basic applications, but not in-depth calculations.
• Past question papers MUST be consulted to guide the candidates, DO NOT just hand out question paper and memo.
• Familiarize yourself and your learners with the formula sheet. Learners lose too many marks for using/writing incorrect formulae.
• Some teachers are still careless in the classrooms when writing formula e.g. pH = -log [HBr] instead of the formula as it is in the formula sheet. Unfortunately learners think this is correct and imitate their teachers.

QUESTION 8
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
The average score for this question was 59%. Candidates' performance in this question was moderate.
Sub question 8.3 scored the highest at 81 % while 8.5 showed the lowest performance at 22 %.

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
8.1 Candidates failed to distinguish between a galvanic and an electrolytic cell, hence the candidates could not correctly identify the energy conversion taking place. In 8.1 some candidates confused the word mechanical with chemical and wrote " mechanical energy changes to electrical energy"
8.2 A common error candidates made in writing the function of the salt bridge is stating that the salt bridge completes the cell or that the salt bridge is a pathway for the electrons to move. Candidates also refer to the salt bridge as maintaining neutrality of the electrons.
8.3 Candidates failed to know that platinum was an inert electrode and acted as a cathode in this galvanic cell; they therefore failed to see that chlorine gas would be reduced to chloride ions and hence substituted incorrect values into the equation. Candidates also lost marks for the formula of E°cell due to the use of abbreviations. It was also observed that candidates struggle to do basic mathematics in calculating E°anode. There are still candidates write Ecell = Ecat – Ean. Teachers need to know that this not acceptable.
8.4 Based on the candidates answer for question 8.3, candidates struggled to identify metal X, because they had to use the reduction potential value to identify where the metal was placed on the table of reduction potentials. Candidates also did not know how the table worked so they either wrote down the whole half reaction or they made the mistake by identifying the metal as the metal ion.
8.5.1 Candidates struggle to link chemical equilibrium with electrochemistry. So many candidates could not answer this question by saying that the rate of oxidation is equal to the rate of reduction. A common error made by the candidates was that the reaction has stopped. The integration of Le Chatelier's principle into galvanic cell questions was foreign to most candidates.
8.5.2 Candidates could not recall knowledge from grade 10 concerning the solubility rules where the silver ion will react with the chloride ion to form insoluble silver chloride and therefore decreasing the concentration if the chloride ion.

8.5.3 Candidates answered this question poorly because instead of explaining Le Chateliers' Principle the candidates stated Le Chatelier's Principle.

(c) Provide suggestions for improvement in relation to Teaching and Learning
• Educators should emphasize to candidates that they should NOT be using double arrows when writing redox half reactions.
• Giving REASONS why a substance is an oxidising or reducing agent should be taught properly by educators. Candidates do not understand the table of reduction potentials and they do not know that there is a difference between an atom and an ion in terms of oxidising and reducing abilities.
• DEFINITIONS OF THE TERMS; redusing agent, oxidation, oxidising agent and reduction must not just be memorized but also understood by the candidates, as the understanding of these definitions are very important in the application thereof.
• The table of standard reduction potentials must be taught well at school level and must also be INTRODUCED IN GRADE 11 already and not just referred to by the educator when explaining electrolytic cells, so that learners can understand, interpret and use the table.
• Definitions should be studied from the Examination Guidelines. Each learner must be provided with a copy of the Examination Guidelines.
• Misconception in many learners: If a substance cannot be reduced e.g. Na+ ions in question 9.3 then that substance is a strong reducing agent -that is not necessarily true.
• Teachers must avoid using abbreviations when writing formulae .They must write formula the same way they are written in the formula sheet.
• Develop exercises that integrate topics in chemical change e.eg Le Chatelier's principle with galvanic cells or acids and bases.
• Use demonstrations when teaching electrochemistry.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
• Rather avoid using the words oxidized and reduced as you are adding more confusing vocabulary –limit the vocabulary to oxidation, reduction, reducing agent and oxidising agents.
• Learners must group oxidation/ reducing agent/ anode together in their thinking as these are all related.
• Subject advisors need to find out if teachers are consulting CAPS document and exam guidelines when preparing for lessons. Some learner responses indicate that some of the incorrect responses were taught in class. For example the whole center would write "The salt bridge connects the two half cells"

QUESTION 9
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
The average score for this question was **27 %.** Candidates' performance in this question was VERY POOR.
Sub question 9.1 scored the highest at 51% while 9.3 showed the lowest performance at 13 %.

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
9.1 A number of candidates could not explain the term electrolysis, instead they gave the definition of an electrolyte. The energy conversion was also confused with the energy conversion of a galvanic cell.
9.2.1 Many candidates got this question wrong. Candidates do not know the difference between the electrolysis of an ionic solution and the electrolysis of a molten ionic substance. Therefore the candidates do not recognise that water can also act as an oxidizing agent and the candidates then chose the wrong half reaction.
9.2.2 Because candidates for question 9.2.1 wrong they also lost their marks in this question for identifying H_2O as the oxidising agent.
9.3 This question was very poorly answered. Candidates do not understand the table of reduction potentials and they do not know that there is a difference between Na as a reducing agent and Na^+ as an oxidising agent therefore they start explaining this question by stating that Na is a stronger oxidising agent than H_2O.

(c) Provide suggestions for improvement in relation to Teaching and Learning
• Educators should emphasize to candidates that they should not be using double arrows when writing redox half reactions.
• Giving reasons why a substance is an oxidising or reducing agent should be taught properly by educators. Candidates do not understand the table of reduction potentials and they do not know that there is a difference between an atom and an ion in terms of oxidising and reducing abilities.
• Definitions of the terms; redusing agent, oxidation, oxidising agent and reduction must not just be memorized but also understood by the candidates, as the understanding of these definitions are very important in the application thereof.
• The table of standard reduction potentials must be taught well at school level and must also be INTRODUCED IN GRADE 11 already and not just referred to by the educator when explaining electrolytic cells.
• There is a MISCONCEPTION about the explanation of standard reduction potentials when

referring to the table. The candidates' response to the answers based on the table is "When you go down the table of standard reduction potentials or when you descend the table of standard reduction potentials". They don't know how to express themselves or give an explanation regarding the table in 9.3
• Teachers must use teach the reduction potential tables properly. Teachers should try and complete the chapter on fertilizers earlier. Leaners must study all the processes and the preparation of ammonium nitrate and ammonium sulfate. Leaners must be given opportunities to answer different examples of the fertilizer calculations. Educators must always ensure to have revision before exams.
• During lesson preparation, planning and demonstration, teachers must use the policy documents, CAPS, Examination guidelines and Chief Marker's reports.
• More informal assessments should be done with regular feedback to learners to avoid these misconceptions and to expose them in different questioning styles.
• Teacher must make it a point to use examination guidelines when teaching definitions and make copies available for learners. Teachers must revise solubility rules, valency and writing chemical formulae from grade 10. Teachers must also use different teaching modes of teaching to get concepts across, especially the videos and simulation.
• Using a demonstration deal with the basic electrolytic cell (using $CuCl_2$) as the electrolyte to introduce the concepts of anode ,cathode, migration of ions, half reactions and comparing strengths of oxidising agents (e.g. H_2O and Cu^{2+} or H_2O and Na^+) .Learners need to know that the negative substance(Cl^- in this case) (second part in the formula) always migrates to the anode to undergo oxidation (therefore a reducing agent).The first part in the formula has to be compared with water in terms of oxidising abilities. If water is the stronger oxising agent then H_2O will undergo reduction. Or if the substance is a stronger oxidising agent (like Cu^{2+}) then that substance will undergo reduction)
• Group electrolytic cell into two based on their type of electrodes: UNREACTIVE Electrodes (Carbon rods where the electrolyte is either $CuCl_2$, NaCl or Aluminium oxide in cryolite AND REACTIVE electrodes that is electroplating and electro refining.
• Discuss each using a demonstration where possible .Compare and contrast the cells.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
• From learners' responses and misconceptions reflected on question 9.
• Subject advisors should ensure that all teachers for the subject have exam guidelines and policy documents and use it effectively.
• Informal assessments must include all cognitive levels and should be done on a regular basis (SMT to monitor that)
• Syllabus must be tracked, just to make sure that all topics are taught within the stipulated time and intense revision is done.'
• COMMON MEMO DISCUSSIONS for each formal assessment and should be done by

teachers at district level together with the district subject advisors.
• Teachers must be facilitated by the subject advisors.
• Team and PEER TEACHING and preparation are recommended in order to SHARE KNOWLEDGE. Teachers must diversify their teaching material, not relying on one pre-scribed textbook.

• The topic on electrolysis is done in term 3 – a very bust time for teachers. The suspicion is that little time is spent on the topic and there are few exercises to reinforce the concepts on electrolysis. Considering that there are five electrolytic cells to be studied at grade 12 and only 8 to 12 marks in the paper some teachers may be ignoring teaching this topic altogether.
• Misconception amongst learners is that if a substance cannot be reduced then it is a strong reducing agent in this case Na^+.
• The table of reduction potentials is not understood by learners which substances are reducing agents and which substances are oxidising agent and what are the trends in terms of strengths of the agents.

QUESTION 10
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
The average score for this question was **53 %.** Candidates' performance in this question was MODERATE.
Sub question 10.3 scored the highest at 65 % while 10.2 showed the lowest performance at 35 %.

(b) Why the question was poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
10.1.1 Well answered. But a lack of understanding of the flow diagram and naming of compounds. Writing of formulae for substances like ammonium nitrate and nitric acid prove to a challenge.
10.1.2 Candidates answered this question poorly. Many candidates wrote nitrogen oxide instead of nitrogen monoxide.
10.1.3 Many candidates struggle to write the formula for nitric acid and therefore losing the mark.
10.2.1 A common error candidates made was writing combustion instead of oxidation, learners also wrote down the name of the process instead of the name of the reaction.
10.2.2 Because candidates struggle to write chemical formulae, they also struggle to write balanced chemical equations and this was the main reason why learners forfeited these three marks.
10.3.1 This question based on the percentage value on a fertiliser bag was answered well but common errors made by candidates included that it is the percentage of filler or that it is the mass of the fertiliser in the bag.

10.3.2 The calculation question based on the fertiliser bag was very well answered by many candidates, but some candidates only calculated the percentage of phosphorous in each bag and did not carry on calculating the mass of phosphorous in each bag and thus forfeiting a mark.

(c) Provide suggestions for improvement in relation to Teaching and Learning
• REGULAR USE of standard reduction potential table should be highlighted, and each candidate must have a copy of it as to familiarize themselves. Educators should have a memorandum for the past question papers in order to know exactly what is expected because most candidates' misconceptions come from educators teaching methods and short-hand writing.
• Educators should make time (manage time) in teaching these topics (fertilizers and

electrochemistry) to have more time to revise with their candidates and make them write to eliminate wrong spelling and wrong chemical formulae.
• Last topics should be given more attention since there is less time to teach and revise them.
• Candidates and educators must be encouraged to take definitions from the Examination Guidelines. Educators must make it a point to use Examination Guidelines when teaching definitions and make copies available for learners. Educators must revise solubility rules, valency and writing chemical formulae from grade 10. Educators must teach the reduction potential tables properly. Teachers should try and complete the chapter on fertilizers earlier. Leaners must study all the processes and the preparation of ammonium nitrate and ammonium sulfate. Leaners must be given opportunities to answer different examples of the fertilizer calculations. Educators must always ensure to have revision before exams.
• Find time do fertilisers early in the year term 1 preferably. Have charts for the industrial processes on classroom walls. Administer short tests on flow diagrams on a monthly basis throughout the semester 1.

(d) Describe any other specific observations relating to responses of learners and comments that are useful to teachers, subject advisors, teacher development etc.
• More revision should be done with candidates with different question styles and to boost their level of confidence to the calculations bases on the fertilizer bag.
• Teachers should stick to the marking guidelines and stop giving learners marks they do not deserve e.g. if a unit is omitted, learners are awarded marks.
• In each type of assessment definitions must be included formula sheet must be given to learners should be encouraged to use/take formulae as they are from formula sheet.
• Teachers must diversify their teaching material, not relying on one pre-scribed textbook. They should also try to get or download videos to explain difficult concepts.

• Chemical formulae are a challenge to learners-this is content that should have been learnt in earlier grades and will be required in institutions of higher learning.
• In CAPS there are only TWO equations for the preparation of fertilisers and every year ONE of them is asked. There is no reason that learners should not get these marks on this question.
• Practice naming of compounds in the industrial processes.