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EASTERN CAPE
EDUCATION

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NSC 2016 CHIEF MARKER'S REPORT

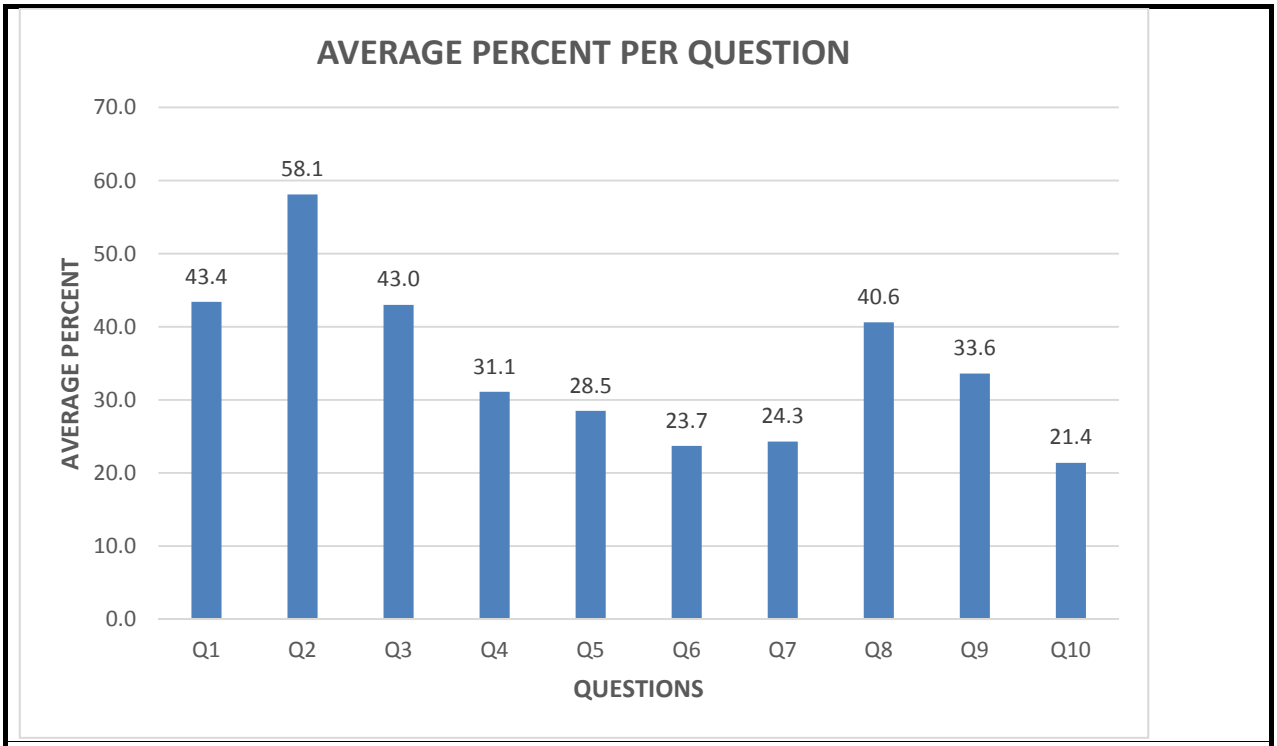
SUBJECT	Physical Sciences

PAPER	2

DATE OF EXAMINATION:	Nov 2016	DURATION:	3 hrs

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

The average percent for the paper was 34,2 % based on the 100 scripts analysed. The 100 scripts that were analysed were a random sample taken from a wide range of centres-100 centres in total. QUESTION 2 (basic organic chemistry) was the most well answered question with an average score of 58,1 % followed by question1, 3 and 8 with scores of 43.4% , 43% and 40 % respectively. QUESTION 10 proved to be the worst performed question in the 100 script sample and also in the 20 dummy scripts marked before memorandum discussion.
The section on organic chemistry (QUESTIONS 2, 3 and 4) was the most well answered section in the paper. This topic is done in term 1 of the school calendar so by the term learners write the final exam they have been exposed to a minimum of three assessments followed by feedback-enough time for the learners to understand the concepts. In contrast question 7, 8, 9 and 10 are done at the end of term 2 (q7 acids and bases) and during term3 (q 8, 9 and 10 - Electrochemistry and Fertilisers). It appears that learners may not have had enough assessment and/or feedback on these topics due to the busy period at which they are done. The average performance in these questions (7, 8, 9 and 10) is 30%.
In addition to question 10 the following questions 5, 6 and 7 had low average scores of 28.4% , 23.7% and 24.3% respectively – all of these questions had stoichiometry calculations. The graph below shows the average percent per question.



It is clear from the graph that learner performance in electrochemistry (Q8-galvanic cells) is improving from last year. One also needs to mention that the question on galvanic cells in the paper was more direct this year i.e. few thinking steps the learner had to go through to reach the answer.

A very similar trend was obtained for the 20 dummies that I marked before the national memorandum discussion meeting.

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 MULTIPLE CHOICE QUESTIONS

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

There was moderate achievement in this question where the average score was 42. %.The most correctly answered question was 1.3, 1.4 and 1.5 with average scores of 58%, 61% and 65% respectively.

Average mark from the sample of 100 :	**8,7**	
SUB-QUESTION	**TOPIC OR ASPECT TESTED**	**AVERAGE % FROM SAMPLE**
1.1	Electrochemical reactions • Electrolytic cells and galvanic cells • Identifying oxidising agent in terms of electron transfer	42
1.2	Chemical equilibrium • Factors affecting chemical equilibrium • Testing the effect of a catalyst on the equilibrium position	35
1.3	Organic molecules • Addition reaction (hydration)	58
1.4	Organic molecules • Identify a substitution reaction	61
1.5	Organic molecules • Organic molecular structures – functional groups, homologous series, saturated & unsaturated structures, isomers	65
1.6	Chemical industry • The fertiliser industry (N P K) • Reaction in Ostwald process	48
1.7	Acids & bases • Acid – base reactions (conjugate acid – base pairs)	28
1.8	Chemical equilibrium • Factors affecting chemical equilibrium • Interpretation of graphs	47
1.9	Electrochemical reactions • Understanding the processes & redox reactions taking place in electrolytic cells	30
1.10	Representing chemical change • Reaction rate: effect of diprotic– vs. monoprotic acid on reaction rate	20

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

Q 1.7 the word NOT was not seen (poor reading).

Q 1.9 the learners had to recognize that there was reduction reaction AND realize that the product

had to be a metal. Many steps to follow before reaching final answer –higher order question.
Q 1.10 the learners did not realize that the one acid is monoprotic whereas the other one is diprotic, and the influence of this on the initial reaction rate and on the final amount of the limiting reactant Magnesium. This a very challenging question even for strong candidates – a cognitive level 4 question.
(c) Provide suggestions for improvement in relation to Teaching and Learning.
More exercises on how to answer multiple questions (elimination method)
(d) Describe any other specific observations relating to responses of learners.
Wrong numbering, leaving lines open.
(e) Any other comments useful to teachers, subject advisors, teacher development etc.
More informal multiple choices test to test answering skills. Techniques on answering multiple choice questions e.g. elimination.

QUESTION 2: ORGANIC MOLECULES

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

Q2 was well answered. The average score 58.1.The most well answered sub question was 2.1.4 at 90%.
Q 2.2.2 should have read "carboxylic acid used" in order to rule out sulphuric acid, which is a reaction condition.

Average mark from the sample of 100 :	**7,6**

SUB-QUESTION	TOPIC OR ASPECT TESTED	AVERAGE % FROM SAMPLE
2.1.1	Organic molecular structures – functional groups, saturated and unsaturated structures; isomers	69
2.1.2	Organic molecular structures – functional groups, saturated and unsaturated structures; isomers	39
2.1.3	Organic molecular structures – functional groups, saturated and unsaturated structures; isomers	65
2.1.4	Organic molecular structures – functional groups, saturated and unsaturated structures; isomers	90
2.2.1	IUPAC naming & formula	71,3
2.2.2	Esterification	39
2.2.3	Plastic and polymers	49,5
2.3.1	Substitution, addition and elimination reactions	36
2.3.2	Substitution, addition and elimination reactions	65

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
Q 2.2.1 Some learners do not know how to place a branch in the structural formula-you still get learners who place think that by bending carbon chain at the at the end carbon forms a branch-not correct.
Q 2.2.2 learners tried to write the structural formula of sulphuric acid
Q 2.2.3 learners do not understand concept of "monomer"
Q2.3.1 Writing "hydrogen" instead of H2.
Q2.3.2 Writing structures with more than one functional group

(c) Provide suggestions for improvement in relation to Teaching and Learning
Teach basics in organic chemistry well-definitions, functional groups, difference between saturation and unsaturation, isomerism etc. Constant practice
More exercises on IUPAC naming and writing STRUCTURAL FORMULAE when the name is given.

(d) Describe any other specific observations relating to responses of learners
Carelessness – 5 bonds per C-atom or bonds omitted
In q2.2.2 some learner responses that functional groups are not known by learners
Lack of identification of type of reaction taking place (q 2.3.2)

(e) Any other comments useful to teachers, subject advisors, teacher development etc.
Mark class assessment tasks according to marking rules during the year so that learners understand what is acceptable and what is not.
Explain the importance of following instructions e.g. " name of" …
Organic chemistry needs constant revision throughout the year

QUESTION 3 ORGANIC MOLECULES

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

The performance in this question is 43%.About half of learners answered well.
Q 3.3 was a big problem. Language learners used to be guided like "mention structure, energy and IMF". In many cases the trend was *stated*, instead of *explained.* Learners refer to carbon chain length as *number of chains*. Combustion reaction either well known or not at all

Average mark from the sample of 100 :	**4,6**

SUB-QUESTION	TOPIC OR ASPECT TESTED	AVERAGE % FROM SAMPLE
3.1	Molecular structures – isomers	69,5
3.2	Molecular structures – isomers	73
3.3	Structures and physical properties – boiling points	72,3
3.4	Structures and physical properties – vapour pressure	55,5

3.5	Oxidation of alkanes	28,7

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

Language : learners battled to express themselves.

Confusion between: break the bonds" and "overcome the forces".

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

Definitions should be taught as they appear in the Exam Guidelines

Teach the relationship between boiling point and intermolecular forces well

In question 3.3 learners should NOT say "..to overcome bonds" but can write "…to overcome intermolecular forces"

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

For the relationship between physical quantities it is incorrect to say for example "*boiling point is directly proportional to strength of intermolecular forces* or *vapour pressure is inversely proportional to boiling point*" one can say "*As strength of intermolecular forces increases boiling point increases*". The fact that one quantity (e.g. boiling point) increases and the other one (e.g. vapour pressure) decreases does not necessarily mean they are in inverse proportion.

(e) Any other comments useful to teachers, subject advisors, teacher development etc.

Make sure every Grade 12 learner has his/her own copy of the Exam Guidelines.

Definitions should be taught as they appear in the Exam Guidelines.

QUESTION 4 ORGANIC MOLECULES

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

Learners did not perform well in this question. The average score is 31.1%.
Learners had to know the content on organic reactions very well to perform well in this question.
Some learners did very well in this question, while others had very low marks.

Working backwards form the final products proved a challenge for most learners

Average mark from the sample of 100 :	**4,0**

SUB-QUESTION	TOPIC OR ASPECT TESTED	AVERAGE % FROM SAMPLE
4.1.1	Substitution, addition and elimination reactions – cracking	33
4.1.2	Substitution, addition and elimination reactions – cracking	63
4.1.3	Functional groups, saturated and unsaturated hydrocarbons – cracking	37

4.2	Addition reactions	18,3
4.3.1	Substitution, addition and elimination reactions	46
4.3.2	Substitution, addition and elimination reactions	40
4.3.3	Substitution, addition and elimination reactions	17,5
4.3.4	Substitution, addition and elimination reactions	31

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

Lack of knowledge of experimental work e.g. the reaction with bromine which is one of the prescribed experiments. It appears that in some centres the experiment was not done. A learner who has not actually seen this, struggles to visualize what is happening in this question

Cracking of alkanes as an elimination reaction often does not receive the necessary attention.

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

Practical work must be done. Videos can also be shown of experiments which do not yield the expected results. Draw up worksheets to give learners on opportunity to recall and apply what they have learnt.
Draw up exercises on organic reaction which give learners the opportunity to work backwards from products to reactants.

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

Some learners related colour change to acid –base reaction in the presence of an indicator since there were three reactants in one container.
While some learners knew the answer for QUESTION 4.3.3 they did not take note of what is given in the question that compound Q is a major product.

(e) Any other comments useful to teachers, subject advisors, teacher development etc.

Develop exercises for teachers and learners on organic reactions where learners can identify type of reactions, work backwards from given products.

QUESTION 5 ENERGY AND CHANGE, RATE AND EXTENT OF REACTIONS

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

The performance in this question is poor. Learners 'average score is 28.5%
Question 5.1.3 and 5.1.4 were the worst answered questions with scores of 20.5% and 7.3% respectively as most learners could not identify the factor influencing reaction rate.

Average mark from the sample of 100 :	**5,7**

SUB-QUESTION	TOPIC OR ASPECT TESTED	AVERAGE % FROM SAMPLE
5.1.1	Activation energy	58
5.1.2	Activation energy, drawing Ep-graph	37,3
5.1.3	Mechanism of catalysis	50,5
5.1.4	How a catalyst affects the rate of a chemical reaction	7,3
5.2.1	Gradient calculation – interpretation of graphs	26,3
5.2.2	Quantitative aspects of chemical change, V_m, stoichiometric calculations	15,5
5.2.3	Quantitative aspects of chemical change, stoichiometric calculations	21
5.3.1	Interpretation of Maxwell-Boltzmann curve	58
5.3.2	Interpretation of Maxwell-Boltzmann curve	59

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

In Q 5.1 definitions not given in full e.g. omission of the word 'minimum…' led to loss of marks

In 5.1.3 and 5.1.4 many learners could not identify the factor that increased reaction rate, many said it was surface area since powdered manganese dioxide was used.

In Q 5.1.4 learners omitted the word "more" in their explanations e.g. a learner would write " molecules have sufficient kinetic energy" instead of "more molecules have sufficient kinetic energy". Some omitted "per unit time e.g. 'More effective collisions per unit time'. If the "per unit time" is omitted in the sentence no mark is given.
In some cases learners lacked proper vocabulary, give only half the correct answer, excluding key words "effective", "more molecules" and "per unit time"

In Q 5.2.2 Learners struggled to read points from a graph for calculating the average gradient even though they knew the formula to use.

In question 5.2.2 some learners did not relate the calculation to mathematics (gradient = $\Delta y/\Delta x$)

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

Grade 11 stoichiometry must be taught very well and revised in Grade 12.

In Grade 10 stoichiometry must focus on meaning and use of the mole concept.

(Most textbooks use mass to mass ratio method in calculations-always use the mole ratio)

Assist learners with answering questions how to include critical points in their reasons e.g. collision theory "more molecules" ,"effective" ,"per unit time".

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

In the graph in 5.1.3 most learners were thrown off course by the change of the reference point on the vertical axis. While the examination panel thought they were making it easy for the learners it actually had the opposite result-learners were confused by the change of the reference point as they know from mathematics that the zero is at the intersection of the x- and y-axis. Most did not write the required values on the vertical axis leading to loss of 2 marks.

(e) Any other comments useful to teachers, subject advisors, teacher development etc.

Stoichiometry in CAPS progresses in depth from Grade 10 to Grade 12 and integrates with all the chemistry topics at grade 12 level. Training workshops on stoichiometry for Grade 10 to 12 teachers are suggested. Include questions on quantitative aspects of chemical change (percentage composition, yields, calculation from balanced equation including limiting reagents etc.) when dealing organic chemistry, rates of reactions, acids and fertilisers.

QUESTION 6 CHEMICAL EQUILIBRIUM

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

There was generally poor performance in this question 23.7%.The worst performed question was 6.3 (completion of the graph) where learners had an average score of 6.5%.Equilibrium principles are not understood by most candidates.

Average mark from the sample of 100 :		**4,3**
SUB-QUESTION	**TOPIC OR ASPECT TESTED**	**AVERAGE % FROM SAMPLE**
6.1	Definition	29,5
6.2.1	Le Chatelier's Principle – Application; with the focus on the phases of reactants	15
6.2.2	Le Chatelier's Principle – Application and explanation	17,8
6.3	Effect of a catalyst on reaction rate	6,5
6.4	Kc – more complex chemistry calculation	29,9

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

6.1 Common responses were " forward reaction equals reverse reaction" omitting the key word 'rate'.

6.2 Some learners missed to state whether the amount of H2S decreases or increases as a result they lost all the 4 marks even if their explanation was correct Explanation of "shifts in equilibrium position" in terms of le Chateliers principle not understood

6.3 Completing the graph correctly proved to be a challenge to most learners

6.4 Since two reaction equations were given some learners chose the incorrect one (the irreversible reaction) to work out Kc from the table. Some learners cannot write down the correct Kc expression. Including the concentration of a solid [S] in the Kc expression led to a loss of marks. Even writing the concentration of the solid [S]and substituting ONE led to a loss of marks

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

Assist learners with exam techniques during the course of the year e.g., reading the question again after answering it to ensure that they gave what was required in full etc.

It is not sufficient to say equilibrium shifts to the left/ equilibrium shifts to the right. Learners must write" equilibrium position shifts to the …."

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

This section of work was taught in most centres as all learners were able to attempt the question but in some centres basic concepts are not taught well e.g. writing of Kc expression, use of the formula n= m/M.

(e) Any other comments useful to teachers, subject advisors, teacher development etc.

Learners must include the sentence "Change is opposed "when asked to explain a shift in equilibrium position as part of the explanation. Teachers must not include solids and liquids in Kc expression and then substitute one after that rather no include the solid/liquid in the

expression from the start.

Emphasise the conditions for chemical equilibrium closed system and reversible reaction in your lessons. The type of arrow used assists in deciding whether the reaction may reach equilibrium or not e.g. double arrow means the reaction will reach equilibrium if container is sealed/system closed.

Refrain from loose/incorrect statement of definitions while teaching (try to listen to yourself being careful and mindful of misconceptions you may be bringing into your lessons e.g. saying something like "reverse reaction equals forward reaction"

QUESTION 7: ACIDS AND BASES

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

Candidates performed poorly in this question scoring an average percent of 24.3%.
The worst performed subsection was the question on stoichiometry 7.2.2(19.4%).

Average mark from the sample of 100 :	**3,9**	
SUB-QUESTION	**TOPIC OR ASPECT TESTED**	**AVERAGE % FROM SAMPLE**
7.1.1	Definition of hydrolysis	21
7.1.2	Application of hydrolysis of a salt in relation to pH	21
7.2.1	Stoichiometric calculation of number of moles	54
7.2.2	More complex stoichiometry	19,4

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

In question 7.1.1 most learners struggled to come up with the definition for "hydrolysis" even those from strong centres.

Responses included "… undergoing ionization in water, dissolving in water or dissociating in water" which were all incorrect – a direct consequence of poor teaching.

In 7.2.2 there was incorrect formula for pH e.g. pH= -log[H2SO4]
Molar ratio incorrectly applied
Some candidates could not change logarithmic form to exponential form.

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

Revise stoichiometry calculations and include them as part of assessment when you are doing acid sand bases.

Each learner must be provided with a copy of the examination guidelines which contains all the definitions.

Teachers need to make learners aware what topics are carried over from Grade 11 to 12 for the final assessment in Grade 12.The exam guidelines clearly stipulates what is carried from Grade 11 to 12.

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

Learners must be given a picture of how many marks do level 1 questions e.g. definitions count in the paper so that they can understand the importance of knowing the definitions. The fact many candidates failed to correctly define hydrolysis tells us that teachers need to assess definitions regularly in the classroom.

(e) Any other comments useful to teachers, subject advisors, teacher development etc.

Training workshop on the teaching method that has to be used when dealing with electrochemical cells would help. Rearrangement of the teaching plan to ensure that the topic on electrochemistry is no taught in term 3 to allow for adequate assessment and feedback to learners.

QUESTION 8: ELECTROCHEMISTRY

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

The average score was 40.6%. There is a noticeable improvement in learners performance in galvanic cells it must be said. The questions on galvanic cells in the paper were more direct this year and learners from most centres attempted this question.

Average mark from the sample of 100 :		**6,5**
SUB-QUESTION	**TOPIC OR ASPECT TESTED**	**AVERAGE % FROM SAMPLE**
8.1.1	Identifying an electrolyte	53
8.1.2	Half-reactions	27,3
8.1.3	Balanced equation for net (overall) reaction; using the Standard Reduction Potential Table	25
8.2.1	Identifying electrodes of a galvanic cell	38,9
8.2.2	Cell notation	38,1
8.2.3	Calculating $E°_{cell}$, using the Standard Reduction Table	58,5
8.2.4	Application: Use the qualitative relationship between Vcell & concentration of product ions and reactant ions for the spontaneous reaction	57,7

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

8.1.1 A strange question as the answer was too obvious as it was staring the learners in the eye-this could have unsettled learners and made some to doubt the answer.

8.1.2 Double arrows still used by some learners in half reactions/some wrote the reduction half reaction instead of the oxidation half reaction.

8.2.1 Table of reduction potentials still not understood by some learners as they chose Silver as the negative terminal.

8.2.2 Cell notation confused with cell reaction. Some responses included Ni/Ni2+ + 2e//Ag+ + e/Ag for cell notation.

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

Teach direct transfer of electrons before moving on to galvanic cells using demonstrations e.g. different metals placed in copper (II) sulphate solution and then silver nitrate . From here you will develop the understanding of the concepts of oxidation/reduction/reducing agent/oxidising agent and writing the net redox reaction. Develop worksheets to assess the concepts and recall of observable changes that take place during these demonstrations and the accompanying half reactions.

Use the term "cell potential" less rather use EMF of the cell more often as learners tend to confuse cell potential with cell reaction.

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

8.2.3 Learners from some centres wrote the formula for Ecell incorrectly e.g.
Ecell = Eoxidation-Ereduction or Ecell=Ecath-Ean. Others confused the cathode and anode E
8.2.4 It appears that the response to question 8.2.4 was guesswork. Teachers need to indicate to learners that increasing the concentration of the oxidising agent increases EMF.

(e) Any other comments useful to teachers, subject advisors, teacher development etc.

Learners tend to confuse the term cell notation with overall cell reaction. Oxidising agents and reducing agents still not understood. A metal e.g. Nickel can only be a reducing agent then its ion (Ni2+) can be the oxidising agent.

Training workshops on the teaching methods required to use when teaching electrochemical cells and the use of the table of standard reduction potentials in answering questions on electrochemical cells.

QUESTION 9: ELECTROCHEMISTRY

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

There was poor performance in this question at 33.6%. The worst performed question was 9.3.3 (writing the reduction half reaction at cathode) at 5.6%.

Average mark from the sample of 100 :	**3,0**	
SUB-QUESTION	**TOPIC OR ASPECT TESTED**	**AVERAGE % FROM SAMPLE**
9.1	Energy conversion in an electrolytic cell	55
9.2	Identifying electrodes	52,5
9.3.1	Identifying products of oxidation & reduction half-reactions	31
9.3.2	Identifying products of oxidation & reduction half-reactions	30
9.3.3	Writing the reduction half-reaction	5,6
9.4	Identifying the alkaline solution based on products formed	35

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

9.2 Learners have a misconception that the carbon electrodes lose electrons instead of the chloride ion Cl- at the anode as result some rote "it loses electrons". It is incorrect to say the carbon electrodes are losing electrons-what loses electrons is the chloride ions from the solution on the carbon electrode P therefore P is anode as oxidation takes place at P.

9.3.3 Learners seem not to understand that the Na+ ion is a weaker oxidizing agent than H2O therefore Na+ cannot undergo reduction in the presence of water.

9.4 Hydroxide ions not associated with alkalinity of a solution

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

In the grade 12 syllabus there are 5 electrolytic cells that learners have to study. Simultaneous demonstrations of pairs of these cells assists in differentiating between them for example using CuCl2 and NaCl as the electrolytes and carbon electrodes in one demonstration pair -list the similarities and the obvious difference that Na+ does not undergo electrolysis when water is present. Do simultaneous demonstration of electroplating and electro-refining and draw up worksheets to assess whether learners can distinguish between the cells, make observations and are able to write down the half reactions at the electrodes.

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

9.4 It appears that some centres acids and bases are not taught well as some candidates could not associate hydroxide ions OH- with the basicity of a solution.

(e) Any other comments useful to teachers, subject advisors, teacher development etc.

Teaching methods for electrochemical cells need to be improved-this is not a difficult section of work as most of the knowledge learners need is on the reduction potential table-learners need to know how to use the table correctly.

QUESTION 10 CHEMICAL INDUSTRY: FERTILISER INDUSTRY

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

This was the worst answered question in the paper with an average score of 21.4%.Question 10.1.4 ,10.1.5 (writing equations for reactions) and 10.2(calculation) were the worst answered questioned.

Average mark from the sample of 100 :	**3,0**	
SUB-QUESTION	**TOPIC OR ASPECT TESTED**	**AVERAGE % FROM SAMPLE**
10.1.1	Identifying the Haber process	58
10.1.2	Identifying the Contact process	48
10.1.3	Steps in the Contact process	29
10.1.4	Steps in the Contact process: Writing a balanced chemical equation	16,7
10.1.5	Writing a balanced chemical equation from the products of the Haber- and Contact process	13
10.2	Understanding the concept of the NPK ratio; calculate NPK ratio	16,6

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

10.1.1 to 10.1.3 industrial processes not known by learners. This section is done last in the annual teaching plan so many schools may not have given enough time to teaching it.
10.1.4 and 10.1.5 generally writing chemical equation proved a big challenge for the learners. The questions 10.1.4 and 10.1.5 demanded a lot thinking on the part of the learners-first they needed to understand the industrial processes Haber and contact process then remember the formula ,write and balance the equations-seemingly this was demanding to the learners. Equations incomplete Equations not balanced 10.2 First time that a question on fertiliser ratio was asked in this way. Learners struggled working out the amount of potassium in the bag/some set out meaningless percentages. The meaning of 36 and 20 kg in the bag was not understood by some candidates
(c) Provide suggestions for improvement in relation to Teaching and Learning
10.1.4 Charts showing the industrial processes displayed in the classroom from the beginning of the year do assist. At certain periods during the year you can have a quiz competition on filling gaps (missing reactants) in equations for the industrial processes. The quiz can be repeated if you are not convinced that learners know the industrial processes.
10.1.5 There are two fertilisers in the syllabus just memorise the two names and formulae and the reactants and ammonia is common reactant.
(d) Describe any other specific observations relating to responses of learners
Generally writing balanced equations for reactions is a challenge to most learners especially when they have to recall the industrial processes.
(e) Any other comments useful to teachers, subject advisors, teacher development etc.
This section is easy part of the chemistry syllabus. The challenge is that it is done very late in the school year. A way has to be found to rearrange the teaching plan so that topics where learners can score marks are done early to ensure learner mastery of the content.