Province of the
EASTERN CAPE
EDUCATION

ASSESSMENT AND EXAMINATIONS DIRECTORATE
Bundy Park, Private Bag 4571, King William's Town, 5600
REPUBLIC OF SOUTH AFRICA, Website: www.ecdoe.gov.za

NSC 2015 CHIEF MARKER'S REPORT

SUBJECT	Physical Sciences

PAPER	**2**

DATE OF EXAMINATION:	November 2015	**DURATION:**	**3 HOURS**

This section of the instrument is aimed at providing valuable feedback to schools, subject advisors, teachers and learners about common errors committed by candidates in the answering of questions, to assist teachers and subject advisors to identify areas that need to be given special attention in the teaching and learning of the subject in 2015.

Your responses will be based on two parts:

Section 1: General overview of Learner performance in the question paper as a whole

Section 2: Comment on candidates' performance on individual questions (Detailed explanations must be provided **per question** as follows: (You may include sub questions where necessary)

(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
(b) Why the question was poorly answered?
(c) Provide suggestion for improvement in relation to teaching and learning
(d) Describe any other specific observations relating to responses of learners
(e) Any other comments useful to teachers, subject advisors, teacher development

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

Overall learner performance in this paper was average. It was clear that questions on organic chemistry (question 2, 3 and 4) were answered the best by candidates. This shows an improvement in the teaching of the topic of organic chemistry at schools.
Question 5, 6 and 9 were answered poorly. The drawing of sketch graphs and interpretation skills were found lacking and most learners struggled with these types of questions.
Teachers must follow the Exam Guidelines (pg 5 and 6).
Definitions are marked “2 or 0” - whilst most learners could explain e.g. what electrolysis is, they left out key words and consequently lost both marks.
Definitions should be taught from the Examination Guidelines only.
From the marking process one could see that many learners did not understand the concepts of oxidising agents/reducing agents. Learners were confusing oxidising agents (Zn^{2+} and Cu^{2+} ions) with the reducing agents (Zn and Cu) e.g. “Zn is a stronger oxidising agent than Copper”.
Revision of stoichiometric calculations is very important as the weighting of the prescribed content in the exam paper allows for 84 marks from “Chemical Change” (pg 5).
The importance of correctly written formulae should be emphasised as no marks are awarded if a calculation starts off with an incorrect formula e.g
incorrect Kc formula = $\frac{0}{4}$.
Learners should be issued with their own set of Exam Guidelines/ datasheets and teachers should mark according to the marking guidelines/rules throughout the year so that learners practice their exam writing skills from early on.

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?**
Q1.6-1.10 poorly answered

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
Q1.2 Few learners knew that rate has amount and time factor in its definition Q1.4 Lack of knowledge of which van der Waals forces are between which molecules. Q1.5 Some learners could not relate their knowledge of the function of a catalyst to the given graph. Q1.6 Learners did not relate hydrolysis to the presence of water as a reagent in the reaction given Q1.7 Learners did work out the molecular formula but missed that the question stated "empirical formula" Q1.8 A very difficult question as it covering a complex reaction. Q1.9 Learners not used to identifying electrodes made up of solutions only. Something new to the syllabus.

(c) Provide suggestions for improvement in relation to Teaching and Learning
Revise MCQs together with longer questions. Teach oxidation numbers well in grade 11 and revise in grade 12. Give exercises where learners are required to identify reducing agents/oxidizing agents from balanced equations. Definitions have to be emphasized and tested regularly throughout the year. Educators must encourage learners to develop a glossary of key terms per section and they must understand those terms and they must be able to differentiate between terms, i.e. they must be encouraged to contrast and compare terms. Teachers must make it a habit on the part of the learners to work out the answer before they choose an option in MCQ.

(d) Describe any other specific observations relating to responses of learners
The most popular answer for 1.7 was “D”. This means that learners knew how to write out the molecular formula for 1,2dibromoethane but missed what the question wanted which was the “empirical formula”. Q1.8 D

(e) Any other comments useful to teachers, subject advisors, teacher development etc.
Classroom visits by subject advisors, to support and identify gaps in teaching, must be conducted on a regular basis. Learners do not regard Question 1 as a source of marks. This may be attributed to the fact that most educators ignore multiple-choice questions. Continuous assessment focusing on terminology would benefit the learners. The answer sheet in the answer book must not be used. Pupils must follow the instructions given on the exam paper.

QUESTION 2
(a) **General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?**
Moderately well

(b) **Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.**
Q2.1.4 Common error was in identifying the length of the chain, omission of hyphens and incorrect order of side chains. Common error was also the omission of the fourth bond around the carbon or writing out the full structural formula. Q2.1.5 The common error was to write but-2-one.

(c) **Provide suggestions for improvement in relation to Teaching and Learning**
Q2.1.2 Phrasing of questions should be similar to exam questions e.g. instead of asking for the functional group one needs to be specific 'Write down the structural formula of the functional group of…' Q2.1.4 Practise basic rules of naming organic compounds like numbering (writing the numbers in pencil). Learners must understand that the longest chain need not be in a straight line. Q2.1.5 Teachers need to advise learners to avoid leaving out the "an" in butan-2-one. It might be better to write the "2" in front of the name e.g. 2-butanone

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

(e) **Any other comments useful to teachers, subject advisors, teacher development etc.**
Teach this topic well and continuously revise it as Organic chemistry carries a third of the marks in Paper 2.

QUESTION 3
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
Moderately well.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
Q3.1.2 Similar to Q2.1.2 Q3.1.3 Some learners omitted the word “acid” and consequently forfeited the mark. Q3.1.6 and Q3.2.1 Additional hydrogens (more than 2 on either carbon) led to the loss of both marks.

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

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

(e) Any other comments useful to teachers, subject advisors, teacher development etc.
Practise IUPAC nomenclature as it eliminates the possibility of mistakes such as but-2-ol in stead of 2- butanol /butan-2-ol or but-2-one in stead of 2-butanone/ butan-2-one.

QUESTION 4
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
Poorly answered.

(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 Inadequate definitions e.g. learners wrote down the function of a functional group "structure that distinguishes one homologous series from another". Q4.2. and Q4.3 It appears there is a great deal of improvement in how teachers deal with intermolecular forces and physical properties . Q4.5 The comparison was lacking. Q4.6 New question requiring stoichiometry that is largely taught in grade 11. Some learners were not aware that the coefficients can be used for mole ratios/ volume ratios (Avogadro`s Law) and as a result they converted moles to volume using molar volume at STP=22,4 dm^3 (incorrectly so as the gases are not at STP). Lack of understanding of the concept of limiting reactant. Learners used the excess reactant (Oxygen) to calculate the answer.

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

(d) Describe any other specific observations relating to responses of learners
Q4.1Some learners from good performing centres left out this question - something which indicates that memorizing definitions is not a priority. Q4.6 Learners lacked distinction between limiting reactant and excess reactant.

(e) Any other comments useful to teachers, subject advisors, teacher development etc.
Curriculum officials must organize training of teachers on quantitative aspects of chemical change. Provide assessment tasks on stoichiometric calculations when teaching rates of reaction/ chemical equilibrium/ acids and bases and electrochemistry. Questions on quantitative aspects of chemical change integrates well with all the topics.

QUESTION 5
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
Poorly answered.

(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 Some learners missed the fact that by definition rate involves amount and time and ended up mentioning 2 measuring instruments for amount but no timing instrument. Some went as far as mentioning apparatus that are not graduated e.g. test-tubes/conical flasks. Q5.2 and Q5.3 Graph interpretation proved a challenge to most learners. Q5.4 Some learners confused higher rate with a lower gradient as they drew the graph for experiment 2 below the graph of experiment 1. Some had graphs not starting at the origin - something which indicates that some learners never practised drawing sketch graphs in class. Q5.5.1 Learners generally do not understand the use of ratios in stoichiometric calculations. Most were able to use the correct formula to calculate the number of moles of acid, but could not relate the substances by using the given ratio in the equation to calculate the number of moles of Zinc.

(c) Provide suggestions for improvement in relation to Teaching and Learning
Teachers need to understand that this is an important section to illustrate and assess understanding of investigative processes , the relationship between theory and experiment, the importance of empirical data and mathematical modeling of relationships. Practical investigations should form part of teaching this section of the CAPS document (pg. 123)

(d) Describe any other specific observations relating to responses of learners
Lack of data interpretation from tables and linking it to sketch graphs. Guesswork in Q5.2 and Q5.3 for some learners.

(e) Any other comments useful to teachers, subject advisors, teacher development etc.
Curriculum officials must encourage School Principals to resource Science Departments through school funds. If there are well resourced schools in your area, for example Dinaledi schools, make arrangements for clusters of schools to share the laboratory at pre- arranged times. Subject advisors should assist/train inexperienced teachers. Teachers should refrain from doing practical work only for the sake of compliance to SBA guidelines.

QUESTION 6
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
Moderate to poorly answered.

(b) Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconceptions.
Q6.2 Learners still uses Kc= [Products]/[Reactants] for the Kc expression Others had incorrect expressions like $Kc=[X_3]/[X_2]$, $Kc = [2X_3]/[2X_2]$ or $Kc= [X_2]^2/[X_3]^3$. Q6.3 Learners left out key phrases e.g. “change is opposed” or “reverse reaction is favoured”. Learners use “equilibrium shifts to the left” and not “equilibrium position shifts to the left”. Q6.4 Learners could not interpret the graph correctly. This question had a lot of reasoning to do for 1 mark. Learners saw a point of intersection and concluded that the answer is “equal to”. Q6.5 Lack of graph interpretation skills and lack of understanding / application of Le Chatelier’principle. Q6.6 The ‘peak’ of the second curve (400˚C) was not shifted to the right.

(c) Provide suggestions for improvement in relation to Teaching and Learning
Learners take time to visualize equilibrium. Use resources from the internet when teaching equilibrium principles. Spend time on concentration versus time , rate versus time and number of mole versus time graphs to assist learners with interpretation. Prepare assessment tasks where learners write out Kc expressions for various kinds of reactions. Stress the fact that the concentration values in the Kc expression are concentrations at equilibrium. Teachers need to expose learners to various types of Kc calculations e.g. Calculating Kc from graphs, the initial amounts given or from concentrations given at equilibrium.

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

(e) Any other comments useful to teachers, subject advisors, teacher development etc.
Do not use the term “equilibrium shift” in your teaching –rather use “reverse/forward reaction favoured”.

QUESTION 7
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
Poorly answered.

(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 Learners wrote “Haber process” instead of hydrolysis. Q7.2.1 Even those learners who identified the process as hydrolysis could not give the correct reason for the acidic nature of the salt solution – common error “ pH is less than 7” Q7.2.1 Incorrect conversion of cm^3 to dm^3. Q7.2.2 Maximum score only 6/8 marks as learners misunderstood the question. Q7.3 Learners lost 3 marks for using incorrect formulae e.g. pH = - log [OH-]

(c) Provide suggestions for improvement in relation to Teaching and Learning
When doing pH calculations use both bases and acid concentrations. Teach hydrolysis well and know that there are only three types of salts that are examinable namely ammonium salts, salts of carbonic acids and salts of carboxylic acids e.g. ethanoic acid /oxalic acid etc. The weaker base/stronger conjugate acid- base pair will undergo hydrolysis e.g. in NH_4Cl (salt of a weak base (NH_3) and a strong acid (HCl)) the NH_4^+ ion will undergo hydrolysis as it is a relatively strong acid.

• **(d) Describe any other specific observations relating to responses of learners**
• Some learners wrote the pH formula correctly but only substituted the concentration of the base.
• In some centres one could see that the theory was not but the practical visualization of what is happening was not there.

(e) And other comments useful to teachers, subject advisors, teacher development etc.
Subject advisors must organise a workshop for teachers on this topic at the end of term 1/beginning of term 2.The subject advisors need to ensure that titrations are done at all schools. Revise stoichiometric calculations.

QUESTION 8
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
Moderate to poorly answered.

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(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 Common mistakes included writing incorrect standard conditions e.g. temperature 273K or 25^{o}, pressure 101,3 x 10^{5} kPa or 10kP,concentration 0,1 mol.dm^{-3} or 1 mol.dm^{3}. Q8.2.1 Most candidates answered this question well although some learners still use both arrows (⇌)instead of one (→). Q8.2.2 Some learners tend to create their own formula instead of using the one supplied in the datasheet. Some learners did not identify the metal Q as required- thus forfeiting a mark. Q8.3.2 Identifying the metal in the cathode proved to be a challenge to most learner

(c) Provide suggestions for improvement in relation to Teaching and Learning
Standard conditions for electrochemical cells should be emphasized to learners and the teacher needs to point out that the temperature given in tables (standard temperature 273K) is not the standard condition for electrochemical cells. As indicated earlier, teachers should provide learners with datasheets that they must use for class work as well as tests/exams. Teachers need to assist learners with basic mathematical skills. Learners from some centres missed that -(-0,40) = + 0,04 Teachers must bring to the attention of learners that in Physical Sciences marks are awarded for the correct formula, the correct substitution and the correct answer with units. Emphasise the need for platinum in cells involving gases and aqueous solutions. Avoid using unconventional formulae e.g. $E_{cell}= E_{cat} - E_{an}$ as learners tend to imitate teachers.

(d) Describe any other specific observations relating to responses of learners
Some learners identified Q (the anode) as Ni^{2+}. Both first language and second language learners struggled to explain their answers to Q8.4-some wrote half a page to a page. Other responses included " I used the table of reduction potentials"/ "it was arranged alphabetically".

(e) Any other comments useful to teachers, subject advisors, teacher development etc.
Question which challenge the language abilities of learners should be avoided. Teachers must study the marking rules in the Exam Guideline Physical Sciences (page 33 to 37) Assist learners with exam techniques during the course of your teaching e.g. one question per page / check all answers. The sub-directorate MSTE should conduct workshops in term 2 on electrochemical processes.

QUESTION 9
(a) General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?
Very poorly answered.

(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 Inadequate information given by learners when defining “electrolysis” e.g. “compound” instead of “ionic compound”.
Q9.2 Learners misread the question as “what is the function of the battery”.
Q9.4 The concept of oxidising agents/reducing agents is a challenge to learners.

(d) Provide suggestions for improvement in relation to Teaching and Learning
The table of reduction potentials clearly indicates which substances are oxidizing agents and which are reducing agents. Practise comparing strengths of agents and allow them to write down their responses Check whether, when comparing oxidizing ability, they use metallic ions or the atoms in their responses and give the necessary feedback.

(d) Describe any other specific observations relating to responses of learners
Most learners gave the correct response to 9.5. This can be attributed to the fact the question was similar to a question in the trial exam - question 9.

(e) Any other comments useful to teachers, subject advisors, teacher development etc.
Do revision from previous national exam papers..

QUESTION 10
(a) **General comment on the performance of learners in the specific question. Was the question well answered or poorly answered?**
Moderately well.

(b) **Why was the question poorly answered? Also provide specific examples, indicate common errors committed by learners in this question, and any misconception**
Q10.1 Learners could not write a balanced equation. Q10.2 and Q10.2.3 There is no clear distinction between rate and yield. Q10.3 Percentage composition question was unexpected.

(c) **Provide suggestions for improvement in relation to Teaching and Learning**
Teachers need to spend more time on industrial processes in the section on fertilizers. During teaching, prepare questions that integrate concepts learnt in rates of reaction/chemical equilibrium/ acids and bases with theory taught in section on fertilisers

(d) **Describe any other specific observations relating to responses of learners**
Learners made up their own NPK ratios in an attempt to solve this problem.

(e) **Any other comments useful to teachers, subject advisors, teacher development etc.**
Subject advisors should conduct two workshops to assist teachers with quantitative aspects of chemical change.

_____Géida van der Merwe_____ ___December 2015_____

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NAME OF THE CHIEF MARKER: SIGNATURE DATE