Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2012

PHYSICAL SCIENCES P2 MEMORANDUM

MARKS: 150

This memorandum consists of 13 pages.

LEARNING OUTCOMES AND ASSESSMENT STANDARDS		
LO1	**LO2**	**LO3**
AS 11.1.1 Plan and conduct a scientific investigation to collect data systematically with regard to accuracy, reliability and the need to control variables.	**AS 11.2.1** Define and discuss basic prescribed and scientific knowledge.	**AS 11.3.1** Recognise, discuss and compare scientific and indigenous knowledge systems and knowledge claims by indicating the correlation among them, and explain the acceptance of different claims.
AS 11.1.2 Seek pattern and trends, represent them in different forms to draw conclusions, and formulate simple generalisations.	**AS 11.2.2** Express and explain prescribed scientific theories, models and laws by indicating the relationship between different facts and concepts in own words.	**AS 11.3.2** Identify ethical and moral issues related to the development of science and technology and evaluate the impact (pros and cons) of the relationship from a personal viewpoint.
AS 11.1.3 Apply known problem-solving strategies to solve multi-step problems.	**AS 11.2.3** Apply scientific knowledge in everyday life contexts.	**AS 11.3.3** Evaluate the impact of scientific and technological knowledge on sustainable development of resources and suggest long-term and short-term strategies to improve the management of resources in the environment.
AS 11.1.4 Communicate and present scientific arguments with clarity and precision.		

GUIDELINES FOR MARKING

This section provides guidelines for the way in which marks will be allocated. The broad principles must be adhered to in the marking of Physical Sciences tests and examinations.

1.1 MARK ALLOCATION

1.1.1 **Definitions:** Two marks will be awarded for a correct definition. No marks will be awarded for an incorrect or partially correct definition.

1.1.2 **Calculations:**

- Marks will be awarded for: correct formula, correct substitution, correct answer with unit.
- No marks will be awarded if an incorrect or inappropriate formula is used, even though there may be relevant symbols and applicable substitutions.

1.1.3 **Explanations and interpretations:** Allocation of marks to questions requiring interpretation or explanation e.g. AS 1.4, 2.2, 2.3, 3.1, 3.2 and 3.3, will differ and may include the use of rubrics, checklists, memoranda, etc. In all such answers emphasis must be placed on scientific concepts relating to the question.

1.2 FORMULAE AND SUBSTITUTIONS

1.2.1 Mathematical manipulations and change of subjects of appropriate formulae carry no marks, but if a candidate starts with the correct formula and then changes the subject of the formula incorrectly, marks will be awarded for the formula and the correct substitutions. The mark for the incorrect numerical answer is forfeited.

1.2.2 When an error is made during **substitution into a correct formula**, a mark will be awarded for the correct formula and for the correct substitutions, but **no further marks** will be given.

1.2.3 Marks are only awarded for a formula if a calculation had been **attempted,** i.e. substitutions have been made or a numerical answer given.

1.2.4 Marks can only be allocated for substitutions when values are substituted into formulae and not when listed before a calculation starts.

1.2.5 All calculations, when not specified in the question, must be done to two decimal places.

1.3 UNITS

1.3.1 Candidates will only be penalised once for the repeated use of an incorrect unit **within a question or sub-question**.

1.3.2 Units are only required in the final answer to a calculation.

1.3.3 Marks are only awarded for an answer, and not for a unit per se. Candidates will therefore forfeit the mark allocated for the answer in each of the following situations:

- correct answer + wrong unit
- wrong answer + correct unit
- correct answer + no unit.

1.3.4 SI units must be used except in certain cases, e.g. $V \cdot m^{-1}$ instead of $N \cdot C^{-1}$, and $cm \cdot s^{-1}$ or $km \cdot h^{-1}$ instead of $m \cdot s^{-1}$ where the question warrants this. (This instruction only applies to Paper 1.)

1.4 POSTIVE MARKING

Positive marking regarding calculations will be followed in the following cases:

1.4.1 **Sub-question to sub-question**: When a certain variable is calculated in one sub-question (e.g. 3.1) and needs to be substituted in another (3.2 or 3.3), e.g. if the answer for 3.1 is incorrect and is substituted correctly in 3.2 or 3.3, **full marks** are to be awarded for the subsequent sub-questions.

1.4.2 **A multi-step question in a sub-question**: If the candidate has to calculate, for example, current in the first step and gets it wrong due to a substitution error, the mark for the substitution and the final answer will be forfeited.

1.4.3 If a final answer to a calculation is correct, full marks will not automatically be awarded. Markers will always ensure that the correct/ appropriate formula is used and that workings, including substitutions, are correct.

1.4.4 Questions where a series of calculations have to be made (e.g. a circuit diagram question) do not necessarily always have to follow the same order. FULL MARKS will be awarded provided it is a valid solution to the problem. However, any calculation that will not bring the candidate closer to the answer than the original data, will not count any marks.

1.4.5 If one answer or calculation is required, but two given by the candidate, only the first one will be marked, irrespective of which one is correct. If two answers are required, only the first two will be marked, etc.

1.4.6 Normally, if based on a conceptual mistake, an incorrect answer cannot be correctly motivated. If the candidate is therefore required to motivate in question 3.2 the answer given to question 3.1, and 3.1 is incorrect, no marks can be awarded for question 3.2. However, if the answer for e.g. 3.1 is based on a calculation, the motivation for the incorrect answer for 3.2 could be considered.

1.4.7 If instructions regarding method of answering are not followed, e.g. the candidate does a calculation when the instruction was to ***solve by construction and measurement*****,** a candidate may forfeit all the marks for the specific question.

1.4.8 For an **error of principle, no marks** are awarded (Rule 1) e.g. If the potential difference is 200 V and resistance is 25 Ω, calculate the current.

CORRECT	ANSWER (1)	POSSIBLE	ANSWER (2)	POSSIBLE
$I = \frac{V}{R}$ ✓ $= \frac{200}{25}$ ✓ $= 8A$ ✓	$R = \frac{V}{I}$ ✓ $= \frac{200}{25}$ ***x*** $= 8A$ ***x***	$R = \frac{V}{I}$ ***x*** $= \frac{200}{25}$ $= 8A$	$R = \frac{V}{I}$ ✓ $I = \frac{R}{V}$ ***x*** $= \frac{25}{200}$ $= 0{,}125\ A$ ***x***	$I = \frac{V}{R}$ ✓ $= 8A$ ✓

1.5 GENERAL PRINCIPLES OF MARKING IN CHEMISTRY

The following are a number of guidelines that specifically apply to Paper 2.

1.5.1 When a chemical **FORMULA** is asked, and the **NAME** is given as answer, only one of the two marks will be awarded. The same rule applies when the **NAME** is asked and the **FORMULA** is given.

1.5.2 When redox half-reactions are to be written, the correct arrow should be used. If the equation

$$H_2S \rightarrow S + 2H^+ + 2e^- \ (^2/_2)$$

is the correct answer, the following marks will be given:

$H_2S \leftrightharpoons S + 2H^+ + 2e^- \ (^1/_2)$

$H_2S \leftarrow S + 2H^+ + 2e^- \ (^0/_2)$

$S + 2H^+ + 2e^- \leftarrow H_2S \ (^2/_2)$

$S + 2H^+ + 2e^- \leftrightharpoons H_2S \ (^0/_2)$

1.5.3 When candidates are required to give an explanation involving the relative strength of oxidising and reducing agents, the following is unacceptable:

- Stating the position of a substance on Table 4 only (e.g. Cu is above Mg).
- Using relative reactivity only (e.g. Mg is more reactive than Cu).

The correct answer would for instance be:

- Mg is a stronger reducing agent than Cu, and therefore Mg will be able to reduce Cu^{2+} ions to Cu.

The answer can also be given in terms of the relative strength as electron acceptors and donors.

1.5.4 One mark will be forfeited when the charge of an ion is omitted per equation.

1.5.5 The error carrying principle does not apply to chemical equations or half-reactions. For example, if a learner writes the wrong oxidation/reduction half-reaction in the sub-question and carries the answer to another sub-question (balancing of equations or calculations of E^{θ}_{cell}) then the learner is not credited for this substitution.

1.5.6 *When a calculation of the cell potential of a galvanic cell is expected, marks will only be awarded for the formula if one of the formulae indicated on the data sheet (Table 2) is used. The use of any other formula using abbreviations etc. will carry no marks.

1.5.7 In the structural formula of an organic molecule all hydrogen atoms must be shown. Marks will be deducted if hydrogen atoms are omitted.

1.5.8 When a structural formula is asked, marks will be deducted if the candidate writes the condensed formula.

1.5.9 *When an IUPAC name is asked, and the candidate omits the hyphen (e.g. instead of 1-pentene the candidate writes 1 pentene), marks will be forfeited.

SECTION A

QUESTION 1

1.1	Exothermic (reaction). ✓	[11.2.1]	(1)
1.2	Oxidation. ✓	[11.2.1]	(1)
1.3	Monoprotic. ✓	[11.2.1]	(1)
1.4	Empirical formula. ✓	[11.2.1]	(1)
1.5	Electronegativity. ✓	[11.2.1]	(1)
			[5]

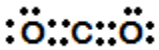
QUESTION 2

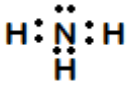
2.1	D ✓✓	[11.2.3]	(2)
2.2	A ✓✓	[11.3.2]	(2)
2.3	B ✓✓	[11.2.3]	(2)
2.4	D ✓✓	[11.2.3]	(2)
2.5	C ✓✓	[11.2.3]	(2)
2.6	B ✓✓	[11.2.3]	(2)
2.7	B ✓✓	[11.2.3]	(2)
2.8	C ✓✓	[11.1.2]	(2)
2.9	A ✓✓	[11.2.3]	(2)
2.10	B ✓✓	[11.2.3]	(2)
			[20]

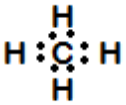
TOTAL SECTION A: 25

SECTION B

QUESTION 3

3.1 3.1.1 Carbon dioxide CO_2 ✓  ✓

Ammonia NH_3 ✓  ✓

Methane CH_4 ✓  ✓

[11.2.3] (6)

3.1.2 Carbon dioxide: linear ✓
Ammonia: trigonal pyramidal ✓
Methane: tetrahedral ✓ [11.2.3] (3)

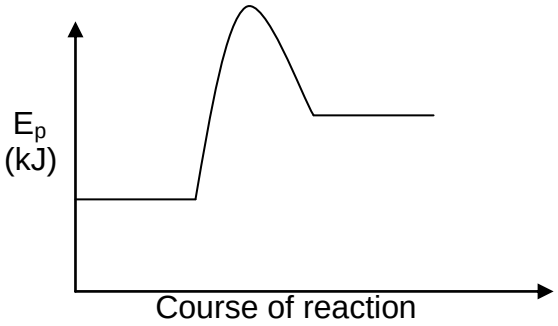
3.1.3 Polar. ✓ The N atom is more electronegative than the H atom. ✓ Both dipole moments work in the same direction to give a net dipole moment in the direction of the N atom. ✓✓ The nitrogen side of the molecule becomes more negative than the hydrogen side ✓ and a polar molecule forms. [11.1.4] (5)

3.1.4 Ammonia. ✓ [11.2.3] (1)

3.1.5 Hydrogen bonds ✓✓ [11.2.3] (2)

3.2 3.2.1 Endothermic. ✓ [11.2.3] (1)

3.2.2 Graph of potential energy against course of reaction



Guidelines for marking graph	
Suitable heading	✓
Both axes labelled correctly	✓
Correct shape of graph	✓✓

[11.1.2] (4)

[22]

QUESTION 4

4.1 4.1.1 $p_1 = 101,3$ kPa ; $V_1 = 100\ cm^3$; $T_1 = 35\ °C + 273 = 308$ K
$p_2 = ?$ $V_2 = 200\ cm^3$; $T_2 = 311\ °C + 273 = 584$ K

$$\frac{p_1V_1}{T_1} = \frac{p_2V_2}{T_2} \checkmark$$

$$\frac{101,3 \times 100}{308} \checkmark = \frac{p_2 \times 200}{584} \checkmark$$

$$p_2 = 96,04 \text{ kPa} \checkmark$$

$\therefore$ pressure in Pa = $9,60 \times 10^4$ Pa ✓ [11.2.3] (5)

4.1.2 The gas particles are in constant motion and so have kinetic energy. ✓ Because of the large spaces between the particles of a gas, the gas occupies the whole container in which it is placed. When the particles hit the sides of the container, they exert a force on the container and hence exert a pressure. ✓ [11.1.4] (2)

4.1.3 Up. ✓ When the temperature is increased, the average kinetic energy of the particles increases and they move faster. ✓ The more often and harder they strike the piston (which is moveable), the greater the force exerted and thus the greater the pressure on the piston, pushing it up. ✓ [11.1.4] (3)

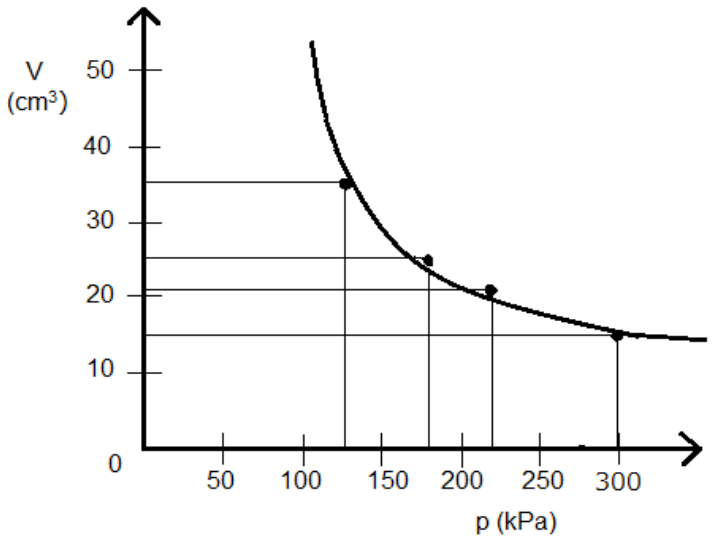
4.2 4.2.1 Volume is inversely proportional to pressure. OR Volume is directly proportional to pressure. ✓✓ [11.1.1] (2)

4.2.2 Boyle's law. ✓ [11.2.1] (1)

4.2.3 The volume of a fixed amount of gas is inversely proportional to the pressure provided the temperature remains constant. ✓✓ [11.2.2] (2)

4.2.4 $p \propto \frac{1}{V}$ ✓✓ [11.1.2] (2)

4.2.5



Guidelines for marking graph	
X-axis labelled correctly	✓
Y-axis labelled correctly	✓
Correct shape of graph	✓✓

[11.1.2] (4)

[21]

QUESTION 5

5.1 Nicotine. ✓✓ [11.3.2] (2)

5.2 (Any One: ✓✓)
Nicorette/Nicotrol/nicotine gum/tobacco gum/chewing tobacco/ nicotine patch/nicogel/topical tobacco paste/ electronic cigarettes. [11.3.2] (2)

5.3 It causes lung cancer/ throat cancer/ mouth cancer, etc. (Any other relevant fact.) ✓ [11.3.2] (1)

5.4
$m(C) = 74,07\ g \quad \therefore n(C) = \frac{74,07}{12} = 6,173$ ✓ $\quad \therefore \frac{6,173}{1,234} = 5$
$m(H) = 8,65\ g \quad \therefore n(H) = \frac{8,65}{1} = 8,65$ ✓ $\quad \therefore \frac{8,65}{1,234} = 7$
$m(N) = 17,28\ g \quad \therefore n(N) = \frac{17,28}{14} = 1,234$ ✓ $\quad \therefore \frac{1,234}{1,234} = 1$ ✓

∴ mole ratio C:H:N = 5:7:1
∴ Empirical formula: $C_5H_7N_1$ ✓

M(molecular formula) = nM(empirical formula)
$162,2\ g{\cdot}mol^{-1} = n(81\ g{\cdot}mol^{-1})$
∴ n = 2 ✓
∴ molecular formula: $C_{10}H_{14}N_2$ ✓ [11.1.3] (7)

[12]

QUESTION 6

6.1 Lemon juice/vinegar. ✓ It has a sour taste. ✓✓ [11.3.2] (3)

6.2 $NaHCO_3$ ✓✓ [11.2.3] (2)

6.3 6.3.1 What is the concentration of the sample of vinegar?/ What concentration of the vinegar sample would be neutralised by 0,2 mol·dm^{-3} of NaOH? ✓✓ [11.1.1] (2)

6.3.2 Ethanoic acid. ✓✓ [11.2.3] (2)

6.3.3

$\frac{c_a v_a}{c_b v_b} = \frac{n_a}{n_b}$ ✓ **OR** $\frac{c_a \times 4}{0,2 \times 8,5} = \frac{1}{1}$ ✓✓ $c_a = 0,43$ mol·dm^{-3} ✓	No of moles of NaOH = n = cV ✓ $= 0,2 \times 0,0085$ ✓ = 0.0017 mol ✓ $C = \frac{n}{V}$ ✓ $= \frac{0,0017}{0,004}$ ✓ $= 0,43$ mol·dm^{-3} ✓

[11.1.3] (6)

6.4 6.4.1 $MgCO_3 + 2HC\ell$ ✓ → $MgC\ell_2 + H_2O + CO_2$ ✓ (Bal. ✓) [11.2.3] (3)

6.4.2 The formation of carbon dioxide (CO_2) gas as one of the products leads to the burping to release the gas. ✓✓ [11.3.2] (2)

[20]

QUESTION 7

7.1 7.1.1 A reaction in which there is a transfer of electrons from one substance to another. ✓✓ [11.2.3] (2)

7.1.2 An oxidising agent is the substance which causes another substance to be oxidised/to lose electrons/It is the substance that is reduced. ✓✓ [11.2.3] (2)

7.1.3 No. ✓ Chlorine is an oxidising agent and as such it will cause the bacteria to be oxidised/Chlorine will be reduced. ✓✓ [11.3.2] (3)

7.1.4 Water.✓ [11.3.2] (1)

7.2 7.2.1 (ii) ✓✓ [11.2.3] (2)

7.2.2 Zn/ zinc ✓ [11.2.3] (1)

7.2.3 $Zn \rightarrow Zn^{2+} + 2e^-$ ✓✓ [11.2.3] (2)

7.2.4 Hydrogen ion. ✓✓ [11.2.3] (2)

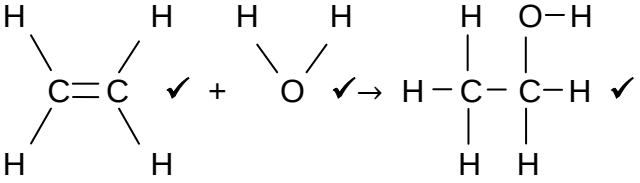
[15]

QUESTION 8

8.1 Hydrocarbons. ✓✓ [11.2.1] (2)

8.2 Alkynes. ✓ [11.2.1] (1)

8.3 8.3.1 Ethanol.✓✓ [11.2.1] (2)

8.3.2  [11.2.3] (3)

8.3.3 People who abuse alcohol cause accidents/ fights/ arguments/lose their jobs/break up families, etc. ✓✓ [11.3.2] (2)

8.4 8.4.1 Substitution. ✓ [11.2.1] (1)

8.4.2 $CH_3C\ell + H_2O$ ✓ → $CH_4O + HC\ell$ ✓ (Bal. ✓) [11.2.3] (3)

[14]

QUESTION 9

9.1 Fractional distillation. ✓ [11.1.2] (1)

9.2 Difference in boiling points. ✓ [11.2.1] (1)

9.3 9.3.1 H ✓ [11.1.2] (1)

9.3.2 A ✓ [11.1.2] (1)

9.3.3 G ✓ [11.1.2] (1)

9.4 Fuel/ cooking gas. ✓ [11.3.2] (1)

[6]

QUESTION 10

10.1 Opencast/open pit mines. ✓ [11.3.2] (1)

10.2 To manufacture triple superphosphate fertilisers. ✓✓ [11.3.2] (2)

10.3 (Any one: ✓✓)
Used as an ingredient in soft drinks, dental cements, catalysts, soaps, pharmaceuticals and in making phosphates which are used in water softeners and detergents. [11.3.2] (2)

10.4 Rock phosphate is insoluble in water and therefore unavailable to plant roots for absorption. ✓✓ [11.3.2] (2)

[7]

QUESTION 11

11.1	Stratosphere. ✓✓	[11.2.1]	(2)
11.2	It can damage skin cells, causing mutations and ultimately skin cancer. ✓✓	[11.3.2]	(2)
11.3	Chlorofluorocarbons. ✓✓	[11.2.1]	(2)
11.4	Propellants in spray cans. ✓ Refrigerants. ✓ Electronic cleaning agents. ✓ Foam and insulating products. ✓ (Any 2)	[11.3.2]	(2) **[8]**

TOTAL SECTION B: 125

GRAND TOTAL: 150