Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 11

NOVEMBER 2011

PHYSICAL SCIENCES P2 MEMORANDUM

MARKS: 150

This memorandum consists of 12 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 11.3.2** 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 11.1.2 Seek patterns 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 11.3.3** 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 11.1.3 Apply known problem-solving strategies to solve multi-step problems.	**AS 11.2.3** Apply scientific knowledge in everyday life contexts.	

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 ALLOCATIONS

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 substation, 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: Allocations of marks to questions requiring interpretation or explanation e.g. AS 1.4, 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 subject of approriate formulae carry no marks, but if a candidate starts off with 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 awarded 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 of 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 $cm \cdot s^{-1}$ where the question warrants this. (This instruction only applies to Paper 1.)

1.4 POSITIVE 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 be 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 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 in 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	POSSIBLE	ANSWER	POSSIBLE
$I = \frac{V}{R}$ √ $= \frac{200}{25}$ √ = 8 A √ (3)	$R = \frac{V}{I}$ √ $= \frac{200}{25}$ × = 8 A × (1)	$R = \frac{I}{V}$ × $= \frac{200}{25}$ = 8 A (0)	$I = \frac{V}{R}$ √ $I = \frac{R}{V}$ × $= \frac{25}{200}$ √ = 0,125 A (2)	$I = \frac{V}{R}$ √ = 8 A √ (2)

1.5 GENERAL PRINCIPLES OF MARKING IN CHEMISTRY (PAPER 2)

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

$$H_2S \rightarrow S + 2H^+ + 2e^- \left(\frac{2}{2}\right)$$

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

H_2S $S + 2H^+ + 2e^- \left(\frac{1}{2}\right)$

H_2S $S + 2H^+ + 2e^- \left(\frac{0}{2}\right)$

H_2S $S + 2H^+ + 2e^- \left(\frac{2}{2}\right)$

$H_2S \leftarrow S + 2H^+ + 2e^- \left(\frac{2}{2}\right)$

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 be for an instance be: Mg is a stronger reducing agent than Cu, and therefore Mg will be also 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 calculation of E^{θ}_{cell}) then the learner is not credited for this substitution.

1.5.6 *When a calculation of the cell potential if 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: ONE-WORD ITEMS

1.1	Dative/co-ordinate covalent bond √	[11.2.1]	(1)
1.2	Pig/cast iron √	[11.2.1]	(1)
1.3	Exothermic (reaction) √	[11.2.1]	(1)
1.4	Indicator √	[11.2.1]	(1)
1.5	Hydrocarbons √	[11.2.1]	(1)
			[5]

QUESTION 2: MULTIPLE-CHOICE QUESTIONS

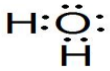
2.1	B √√	[11.2.2]	(2)
2.2	C √√	[11.1.2]	(2)
2.3	D √√	[11.2.3]	(2)
2.4	C √√	[11.2.3]	(2)
2.5	B √√	[11.2.3]	(2)
2.6	A √√	[11.2.2]	(2)
2.7	C √√	[11.2.3]	(2)
2.8	D √√	[11.1.2]	(2)
2.9	A √√	[11.3.3]	(2)
2.10	B √√	[11.3.3]	(2)
			[20]

TOTAL SECTION A: 25

SECTION B

QUESTION 3

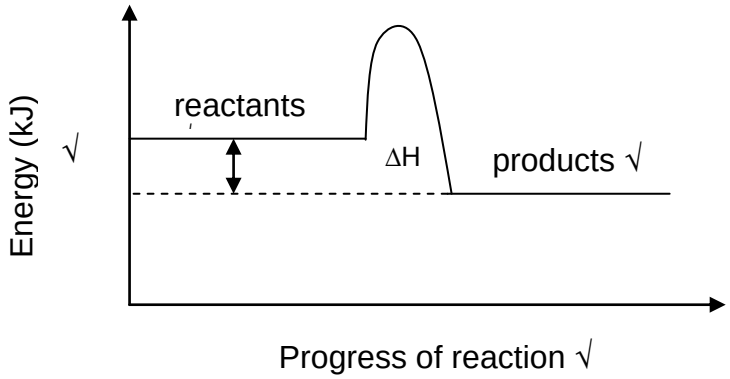
3.1 3.1.1  √ [11.2.1] (1)

3.1.2  √√ [11.2.1] (2)

3.2 Bent or angular √ [11.2.1] (1)

3.3 Exothermic. √ ΔH is negative/less than zero. √√ [11.2.1] (3)

3.4



[11.2.1] (4)

3.5 Polar. √ The O 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 O atom. √√ The oxygen side of the molecule becomes more negative than the hydrogen side √ and a polar molecule forms. [11.1.2] (5)

3.6 Hydrogen bonds √ [11.2.1] (1)

3.7 Bond energy √ [11.2.1] (1)

3.8 3.8.1 E_{Total} (bond breaking) = (2 x H − H) + (O = O)
= (2 x 436) + 499 √
= 1 371 kJ·mol^{-1} √ [11.1.3] (2)

3.8.2 E_{Total} (bond forming) = 4 × O − H
= 4 × 460 √
= 1 840 kJ·mol^{-1} √ [11.1.3] (2)

[22]

QUESTION 4

4.1 4.1.1 What is the relationship between temperature and volume of a gas at constant pressure? √√ [11.1.2] (2)

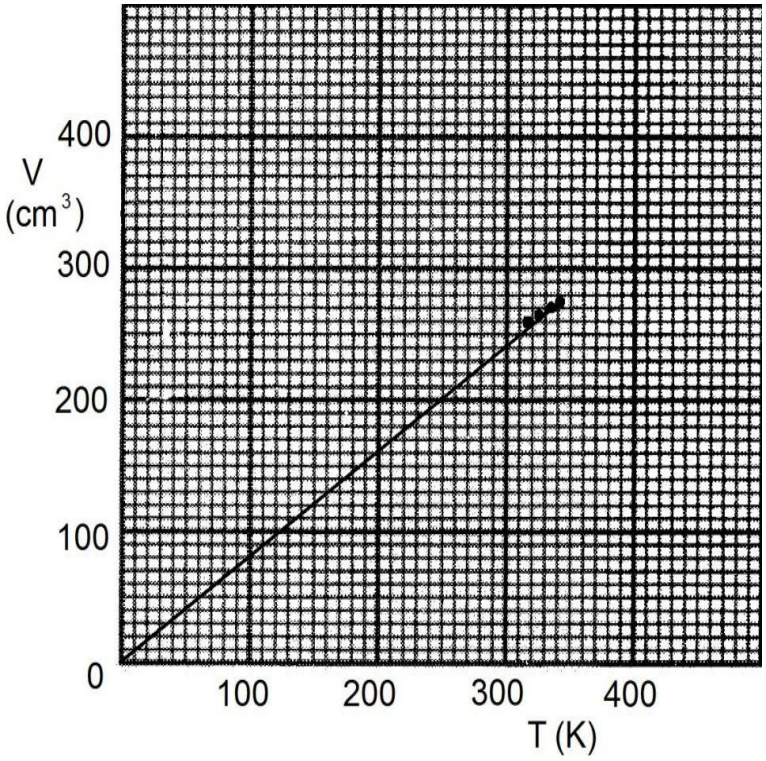
4.1.2 318 K √; 260 cm^3 √ [11.2.3] (2)

4.1.3 V ∝ T √√ [11.1.2] (2)

4.1.4 Volume √ [11.1.1] (1)

4.1.5 (5)

Criteria	Marks
Axes labelled correctly with units	√
Suitable coordinates	√
Correct plotting	√√
Graph extrapolated to zero	√



[11.1.2]

4.2 p_1 = 110 kPa ; V_1 = 125 cm^3 ; T_1 = 25 °C + 273 = 298 K

p_2 = 230 kPa ; V_2 = 135 cm^3 ; T_2 = ?

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \quad √$$

$$\frac{110 \text{ x } 125}{298} √ = \frac{230 \text{ x } 135}{T2} √$$

T_2 = 672, 94 K √

∴ temperature in °C = 672, 94 K − 273

= 399, 94 °C √ [11.1.3] (5)

4.3 p = 70 kPa = 70 000 Pa; V = 200 dm^3 = 0,2 m^3 ; n = 3 mol ;
R = 8,31 $J \cdot K^{-1} \cdot mol^{-1}$; T = ?

$pV = nRT$ √

(70 000) √(0,2) √ = (3)(8,31)T √

∴ T = 561,57 K √ ∴ t = 561,57 − 273 = 288,57 °C √ [11.1.3] (6)

[23]

QUESTION 5

5.1 5.1.1 A solution of which the concentration is known precisely. √√ [11.2.1] (2)

5.1.2 Volumetric/measuring flask √ [11.1.1] (1)

5.1.3 c = 0,1 $mol.dm^{-3}$; V = 250 cm^3 ÷ 1000 = 0,25 dm^3;
$M(COOH)_2.2H_2O$ = (2 x 12) + (6 x 16) + (6 x 1)
= 126 $g.mol^{-1}$ √;
m = ?

$c = \frac{n}{V} = \frac{m}{MV}$ √ $0,1$ √ $= \frac{m}{126 \times 0,25}$ √ ∴ m = 3,15 g √	**OR**	$c = \frac{n}{V}$ $\therefore 0,1 = \frac{n}{0,25} \Rightarrow n = 0,025\ mol$√ m = nM √ = 0,025 x 126 √ = 3,15 g √

[11.1.3] (5)

5.1.4 Weak acid. √ It does not ionise completely in solution. √√ [11.2.1] (3)

5.2 5.2.1 A − Burette √
B − Conical/Erlenmeyer flask √ [11.1.1] (2)

5.2.2 pipette √√, wash bottle √√ (Any 1) [11.1.1] (2)

5.3 $2NaOH + (COOH)_2$ √ → $(COONa)_2 + 2H_2O$ √ (Bal. √) [11.2.3] (3)

5.4 caustic soda √√ [11.3.3] (2)

[20]

QUESTION 6

6.1 $4Fe + 3O_2$ √ → $2Fe_2O_3$ √ (Bal. √) [11.2.3] (3)

6.2 Redox reaction √√ [11.2.1] (2)

6.3 Rust √ [11.3.2] (1)

6.4 0 √ [11.2.3] (1)

6.5 -2 √ [11.2.3] (1)

6.6 Reduction √√ 11.2.1] (2)

6.7 Oxidation is loss of electrons. √√ [11.2.1] (2)

6.8 Fe √√ [11.2.3] (2)

6.9 Galvanising it √√ cover it with a layer of Zn-metal/paint/oil or plastic .√√ (Any 2) [11.3.2] (4)

[18]

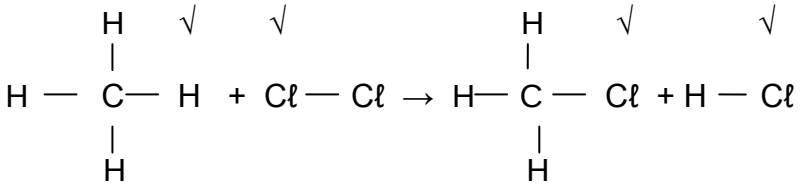
QUESTION 7

7.1 7.1.1 Alkanes √√ [11.2.1] (2)

7.1.2 Ethene √√ [11.2.1] (2)

7.1.3 C √√ [11.2.1] (2)

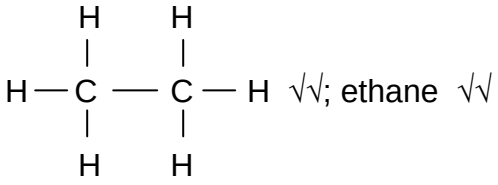
7.1.4



[11.2.3] (4)

7.1.5 Substitution √√ [11.2.1] (2)

7.1.6



[11.2.3] (4)

7.1.7 Addition/hydrogenation √√ [11.2.1] (2)

7.1.8 Margarine √√ [11.3.2] (2)

7.1.9 Elimination √√ [11.2.1] (2)

[22]

QUESTION 8

8.1 Sand √ [11.2.3] (1)

8.2 8.2.1 Fe_2O_3 (s) + 3CO (g) √ → 2Fe (ℓ) + $3CO_2$ (g) √ (Bal. √) [11.2.3] (3)

8.2.2 Liquid √ [11.2.1] (1)

8.3 The carbon dioxide produced as a by-product is a greenhouse gas and a contributor to global warming. √√ **/** Waste materials such as sulphur and other heavy metals can cause soil and / or water pollution. √√ (Any 1) [11.3.3] (2)

8.4 The construction industry √ **/** manufacture of vehicles √ **/**machinery √ **/** tools ✓**/** kitchen utensils**,** √ etc. (Any 1) [11.3.3] (1)

8.5 Cement √√ [11.3.1] (2)
[10]

QUESTION 9

9.1 Carbon dioxide, √ methane, √ nitrous oxide, √ chlorofluorocarbons √ (Any 2) [11.3.1] (2)

9.2 The greenhouse effect is the trapping of heat near the earth's surface by gases (such as carbon dioxide) in the atmosphere. √√ [11.3.3] (2)

9.3 Increase in temperature on earth, √ **/** rising of sea levels √**/** flooding / √ severe drought √ (Any 1) [11.3.3] (1)

9.4 Use cleaner fuels in cars √ **/** Use public transport √**/** Use a bicycle or a scooter instead of a car. √ (Any other suitable example.) (Any 1) [11.3.3] (1)

9.5 The ozone layer protects earth from radiation from the sun. √ It protects us from too much radiation which could lead to skin cell damage or skin cancer. √ [11.3.3] (2)

9.6 Kyoto Protocol/Agreement √√ [11.3.1] (2)
[10]

TOTAL SECTION B: 125

GRAND TOTAL: 150