Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE/*GRAAD* 12

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PHYSICAL SCIENCES P2
FISIESE WETENSKAPPE V2
MEMORANDUM

MARKS/ PUNTE: **150**

This memorandum consists of 16 pages.
Hierdie memorandum bestaan uit 16 bladsye.

GUIDELINES FOR MARKING/*RIGLYNE VIR NASIEN*

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.

Hierdie afdeling verskaf riglyne vir die manier waarop punte toegeken sal word. Die breë beginsels moet tydens die nasien van Fisiese Wetenskappe toetse en eksamens gevolg word.

1.1 MARK ALLOCATION/*PUNTETOEKENNING*

1.1.1 **Definitions/*Definisies*:** Two marks will be awarded for a correct definition. No marks will be awarded for an incorrect or partially correct definition. *Twee punte sal vir 'n korrekte definisie toegeken word. Geen punte sal vir 'n verkeerde of gedeeltelik korrekte definisie toegeken word nie.*

1.1.2 **Calculations/*Berekeninge*:**

- Marks will awarded for: correct formula, correct substitution, correct answer with unit.
  Punte sal toegeken word vir: korrekte formule, korrekte substitusie, korrekte antwoord met eenheid.
- No marks will be awarded if an incorrect or inappropriate formula is used, even though there may be relevant symbols and applicable substitutions.
  Geen punte sal toegeken word waar 'n verkeerde of ontoepaslike formule gebruik word nie, selfs al is daar relevante simbole en relevante substitusies.

1.1.3 **Explanations and interpretations/Verduidelikings en interpretasie:**
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.
Toekenning van punte by vrae wat interpretasie of verduideliking vereis bv. AS 1.4, 2.2, 2.3, 3.1, 3.2 en 3.3, sal verskil en mag die gebruik van rubrieke, kontrolelyste, memoranda, ens. insluit. By al hierdie antwoorde moet die beklemtoning op die wetenskaplike konsepte, met betrekking tot die vraag, val.

1.2 FORMULAE AND SUBSTITUTIONS/*FORMULES EN SUBSTITUSIE*

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.
Wiskundige manipulering en verandering van die voorwerp van toepaslike formules dra geen punte nie, maar as 'n kandidaat begin met die korrekte formule en dan die voorwerp van die formule verkeerd uitwerk, sal punte vir die formule en korrekte substitusie toegeken word.

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.
*Wanneer 'n fout gedurende **substitusie in 'n korrekte formule** begaan word, sal 'n punt vir die korrekte formule en vir korrekte substitusie toegeken word, maar **geen verdere punte** sal toegeken word nie.*

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.
*Punte sal slegs toegeken word vir 'n formule as 'n **poging aangewend was** om 'n berekening te doen d.w.s. substitusie was gedoen of 'n numerieke antwoord word verskaf.*

1.2.4 Marks can only be allocated for substitutions when values are substituted into formulae and not when listed before a calculation starts.
Punte kan slegs toegeken word vir substitusies wanneer waardes in formules ingestel is en nie vir waardes wat voor 'n berekening gelys is nie.

1.2.5 All calculations, when not specified in the question, must be done to two decimal places.
Alle berekenings, wanneer nie in die vraag gespesifiseer word nie, moet tot twee desimale plekke gedoen word.

1.3 **UNITS/*EENHEDE***

1.3.1 Candidates will only be penalised once for the repeated use of an incorrect unit **within a question or sub-question.**
*'n Kandidaat sal slegs een keer gepenaliseer word vir die herhaaldelike gebruik van 'n verkeerde eenheid **in 'n vraag of subvraag.***

1.3.2 Units are only required in the final answer to a calculation.
Eenhede word slegs in die finale antwoord tot 'n vraag verlang.

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.

Punte word slegs vir 'n antwoord en vir 'n eenheid per se toegeken nie. Kandidate sal derhalwe die punt vir die antwoord in die volgende gevalle verbeur:

- *korrekte antwoord + verkeerde eenheid*
- *verkeerde antwoord + korrekte eenheid*
- *korrekte antwoord + geen eenheid*

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).
SI-eenhede moet gebruik word behalwe in sekere gevalle, bv. $V{\cdot}m^{-1}$ inplaas van of $N{\cdot}C^{-1}$, en $cm{\cdot}s^{-1}$ of $km{\cdot}h^{-1}$ inplaas van $m{\cdot}s^{-1}$ waar die vraag dit verlang. (Hierdie instruksie geld slegs by Vraestel 1).

1.4 POSTIVE MARKING/*POSITIEWE NASIEN*

Positive marking regarding calculations will be followed in the following cases:
Positiewe nasien met betrekking tot berekeninge sal in die volgende gevalle geld:

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.
Subvraag na subvraag: *Wanneer 'n sekere veranderlike in een subvraag (bv. 3.1) bereken word en dan in 'n ander vervang moet word (3.2 of 3.3), bv. Indien die antwoord vir 3.1 verkeerd is en word korrek in 3.2 of 3.3 vervang, word volpunte aan die daaropvolgende subvraag toegeken.*

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.
'n Vraag met veelvuldige stappe in 'n subvraag: *Indien 'n kandidaat byvoorbeeld, die aantal mol verkeerd bereken in 'n eerste stap as gevolg van 'n substitusiefout, verloor die kandidaat die punt vir die substitusie sowel as die finale antwoord.*

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.
Indien 'n finale antwoord tot 'n berekening korrek is, sal volpunte nie outomaties toegeken word nie. Nasieners sal altyd verseker dat die korrekte toepaslike formule gebruik word en dat bewerkings, insluitende substitusies korrek is.

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.
Vrae waar 'n reeks berekeninge gedoen moet word (bv. 'n stroombaan diagram vraag) hoef nie noodwendig altyd dieselfde orde te volg nie. VOLPUNTE sal toegeken word mits dit 'n geldige oplossing tot die probleem is. Maar, enige berekening wat nie die kandidaat nader aan die antwoord bring as die oorspronklike data, sal geen punte tel nie.

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.
Indien een antwoord of berekening verlang word, maar twee word deur die kandidaat gegee, sal slegs die eerste een nagesien word, ongeag watter een korrek is. Indien twee antwoorde verlang word, sal slegs die eerste twee nagesien word, ens.

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.
Normaalweg, as dit gebaseer is op 'n voorstellingsfout, kan 'n verkeerde antwoord nie korrek gemotiveer word nie. As die kandidaat derhalwe gevra word met 'n vraag in 3.2 om die antwoord in vraag 3.1 te motiveer, en 3.1 is verkeerd, sal geen punte vir vraag 3.2 toegeken word nie. Maar, as die antwoord in bv. 3.1 gebaseer is op 'n berekening, kan die motivering vir die verkeerde antwoord oorweeg word.

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.
Indien instruksies aangaande metode van beantwoording nie gevolg word nie, bv. die kandidaat doen 'n berekening wanneer die instruksie ***los op deur konstruksie en meting*** *was, mag die kandidaat al die punte vir die spesifieke vraag verbeur.*

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.
Vir 'n ***foutdraendebeginsel,*** *sal* ***geen punte*** *toegeken word nie (Reël 1) bv. As die potensiaalverskil 200 V en die weerstand 25 Ω is, bereken die stroom*.

CORRECT *KORREK*	ANSWER (1) *ANTW. (1)*	POSSIBLE *MOONTLIK*	ANSWER (2) *ANTW. (2)*	POSSIBLE *MOONTLIK*
$I = \frac{V}{R}$ ✓ $= \frac{200}{25}$ ✓ $= 8A$ ✓	$R = \frac{V}{I}$ ✓ $= \frac{200}{25}$ ***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/ *ALGEMENE BEGINSELS VAN NASIEN BY CHEMIE*

The following are a number of guidelines that specifically apply to Paper 2.
Die volgende is 'n aantal riglyne wat spesifiek op Vraestel 2 van toepassing is.

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.
*Wanneer 'n chemiese **FORMULE** gevra word en die **NAAM** word as antwoord gegee, sal slegs een van die twee punte toegeken word. Dieselfde reël geld wanneer die **NAAM** gevra word en die **FORMULE** gegee word.*

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:
Wanneer redokshalfreaksies geskryf moet word, moet die korrekte pyltjie gebruik word. Indien die bostaande vergelyking die korrekte antwoord is, sal die volgende punte toegeken word:

$H_2S \leftrightharpoons S + 2H^+ + 2e^-$ ($^1/_2$)
$H_2S \leftarrow S + 2H^+ + 2e^-$ ($^0/_2$)
$S + 2H^+ + 2e^- \leftarrow H_2S$ ($^2/_2$)
$S + 2H^+ + 2e^- \leftrightharpoons H_2S$ ($^0/_2$)

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.

Wanneer kandidate 'n verduideliking moet gee oor die relatiewe sterkte van oksideer- en reduseermiddels, is die volgende onaanvaarbaar.

- *Meld slegs die posisie van 'n stof op tabel 4 (bv. Cu is bo Mg).*
- *Gebruik slegs relatiewe reaktiwiteit (bv. Mg is meer reaktief as Cu).*
- *Die korrekte antwoord sal byvoorbeeld wees: Mg is 'n sterker reduseermiddel as Cu en derhalwe sal Mg in staat wees om Cu^{2+}-ione na Cu te reduseer. Die antwoord kan ook in terme van die relatiewe sterkte van elektronakseptors of donors gegee word.*

1.5.4 One mark will be forfeited when the charge of an ion is omitted per equation.
Een punt sal verbeur word wanneer die lading van 'n ioon per vergelyking weggelaat is.

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.
Die foutdraendebeginsel geld nie vir chemiese vergelykings of halfreaksies nie. Byvoorbeeld, indien 'n leerder die verkeerde oksidasie/reduksie-halfreaksie vir die subvraag skryf en die antwoord na 'n ander subvraag dra (balansering van vergelyking of E^{θ}_{sel}) dan word die leerder nie vir die substitusie gekrediteer nie.

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.
Wanneer 'n berekening van die selpotensiaal van 'n galvaniese sel verlang word, sal punte slegs vir die formule toegeken word as een van die formules op die gegewensblad (Tabel 2) gebruik word. Die gebruik van enige ander formule, die gebruik van afkortings, ens. Sal geen punte dra nie.

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.
In die struktuurformules van 'n organiese molekuul moet alle waterstofatome getoon word. Punte sal afgetrek word vir die weglating van waterstofatome.

1.5.8 When a structural formula is asked, marks will be deducted if the candidate writes the condensed formula.
Wanneer 'n struktuurformule gevra word, sal punte afgetrek word indien die leerder die gekondenseerde formule skryf.

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.
Wanneer die IUPAC naam gevra word en die koppelteken(s) in die naam word uitgelaat (bv. In plaas van pent-1-een of 1-penteen skryf 'n kandidaat pent 1 een of 1 penteen), sal punte verbeur word.

QUESTION/*VRAAG* 1

1.1 B ✓✓ (2)
1.2 C ✓✓ (2)
1.3 A ✓✓ (2)
1.4 C ✓✓ (2)
1.5 C ✓✓ (2)
1.6 A ✓✓ (2)
1.7 A ✓✓ (2)
1.8 C ✓✓ (2)
1.9 B ✓✓ (2)
1.10 D ✓✓ (2)
[20]

QUESTION/*VRAAG* 2

2.1 2.1.1 D ✓ or/*of* F (1)

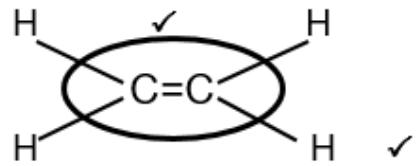
2.1.2 E ✓ (1)

2.2 2.2.1 2,4-dimethyl ✓hex-1-ene ✓/*2,4-dimetielheks-1-een*

Accept/*Aanvaar*: 2,4-dimethyl-1-hexene/*2,4-dimetiel-1-hekseen*

Marking criteria/*Nasienriglyne*:
• Correct stem ie.hex-1-ene/1-hexene./ *Korrekte stam heks-1-een/1-hekseen.* ✓
• Entire name correct./*Hele naam korrek.* ✓

2.2.2



Marking criteria/*Nasienriglyne*:
- Functional group correct./ *Funksionele groep korrek*. 1/2
- Whole structure correct./ *Hele struktuur korrek* 2/2

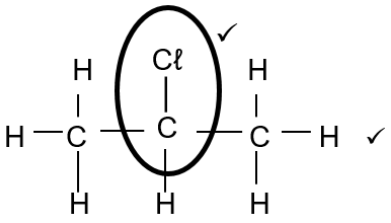
(2)

2.3 2.3.1 C_nH_{2n+2} ✓ (1)

2.3.2 CO_2 ✓ and/*en* H_2O ✓ (2)

2.4 2.4.1

2-chloro✓propane✓/ *2-chloorpropaan*	**IF/INDIEN:** 2 chloropropane/*2 chloorpropaan* (1/2)



Marking criteria/*Nasienriglyne*:
- Three carbons in longest chain/*Drie koolstowwe in langste ketting.*✓
- Functional group on second carbon/*Funksionele groep op tweede koolstof.*✓

Notes/*Aantekeninge*:
Condensed structural formula or semi structural formule./*Gekondenseerde formule of semi-struktuurformule* 1/2
One or more H atoms omitted./Een of meer H atoom weggelaat. 1/2

(2)(4)

2.4.2 Positional/*Posisioneel*✓ (1)

2.5

OPTION/*OPSIE* 1

% O = 32 / M × 100 = 12,5 ✓
M = 256 g·mol^{-1}
n(12) + 1(2n) + 32 = 256 ✓ or/*of* n(12) + 1(2n) = 224

n = 16
% C = 16(12)/256 × 100 ✓ = 75 %
X = 75✓

OPTION/*OPSIE* 2

% (H and/*en* C) = 87,5% ✓ (100% - 12,5%)
RATIO/*VERHOUDING* H : C
2n × 1 : n × 12
1 : 6 ✓
%C = 6/7 × 87,5%✓
= 75%✓

(4)
[18]

QUESTION/*VRAAG* 3

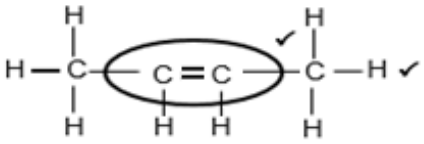
3.1 3.1.1 (a) Substitution/*Substitusie* ✓
OR/*OF*
Hydrolysis/*Hidrolise* ✓ (1)

(b) 2-butanol/*butan-2-ol*✓✓ (2)

Marking criteria/*Nasienriglyne:*	
Stem i.e. butanol./ *Stam butanol d.i. butanol.*	1/2
Whole name correct./ *Hele naam korrek.*	2/2

3.1.2 Reaction 2/*Reaksie 2* ✓ (1)

3.1.3

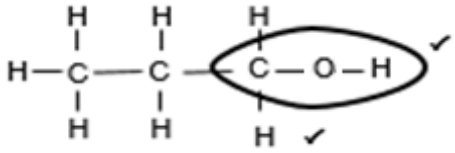


(2)

Marking criteria/*Nasienriglyne*:	
• Functional group correct / *Funksionele groep korrek.*	1/2
• Whole structure correct./ Hele struktuur korrek.	2/2

3.2 3.2.1 To <u>avoid fire</u>./Alcohol catching flame/Alcohol is flammable✓
Om <u>vuur te verhoed</u>./
Om te <u>verhoed</u> dat alkohol <u>vlam</u> vat./Alkohol is <u>vlambaar</u>. (1)

3.2.2



(2)

Marking criteria/*Nasienriglyne*:	
• Functional group correct/ *Funksionele groep korrek.*	1 /2
• Whole structure correct./ *Hele struktuur korrek*.	2/2

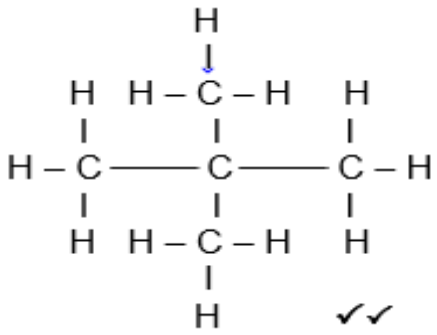
3.2.3 Methanoic acid/*Metanoësuur* ✓ (1)
[10]

QUESTION/*VRAAG* 4

4.1 Compounds with the same molecular formula ✓ but different length of (carbon) chains.✓
Stowwe met dieselfde molekulêre formule, maar verskillende tipe (koolstof) kettings. (2)

4.2 50✓ (kPa) (1)

4.3



✓✓

Marking criteria/*Nasienriglyne*:
- Three carbons in longest chain/*Drie koolstowwe in langste ketting.*✓
- Two methyl groups on second C atom/*Twee metiel groepe on tweede koolstof.*✓

Notes/*Aantekeninge*:
- Condensed structural or semi-structural formula./*Gekondenseerde struktuur formula of semi-struktuurformule.* (1/2)
- Molecular formula/*Molekulêre formule* (0/2)

(2)

4.4
- Chain in **A** longer than that of in **B**/surface area of **A** larger than that of **B**/**A** is less spherical than **B**. ✓
- Strength of London forces✓/induced dipole/dispersion forces STRONGER in **A** ✓ than in **B**.
- *Ketting in **A** is langer as in **B**/oppervlaksarea in **A** is groter as in **B**/**A** is minder sferies as **B**.*
- *Sterkte van intermolekulêre kragte/Londonkragte/geïnduseerde dipole/dispersie kragte is STERKER in **A** as in **B**.*

OR/*OF*
- Chain in **B** shorter than that in **A**/surface area of **B** smaller than that of **A**/**B** is more spherical than **A**.✓
- Strength of London forces✓/induced dipole/dispersion forces WEAKER in **B** ✓ than in **A**.
- *Ketting in **B** is korter as in **A**./oppervlaksarea in **B** is kleiner as in **A**/**B** is meer sferies as **A**.*
- *Sterkte van intermolekulêre kragte/Londonkragte/geïnduseerde dipole/dispersie kragte is SWAKKER in **B** as in **A**.* (3)

4.5 4.5.1 London forces/induced dipole forces/dispersion forces.✓
Londonkragte/geïndudeerde dipool kragte/dispersie kragte (2)

4.5.2 Between molecules of **D** there are hydrogen bonds ✓ in addition to dipole-dipole forces and London forces/dispersion forces/induced dipole forces.
Between molecules of **F** there are dipole dipole forces ✓in addition to London forces/dispersion forces/induced dipole forces.
Hydrogen bonds in **D** are stronger ✓ than dipole-dipole forces in **F**.
OR
Dipole-dipole forces in **F** are weaker than hydrogen bonds in **D**.

*Tussen molekules van **D** is daar waterstofbindings asook dipool-dipool kragte en Londonkragte/dispersiekragte /geïnduseerde dipoolkragte.*
*Tussen molekules van **F** is daar dipool-dipoolkragte kragte asook Londonkragte/dispersiekragte /geïnduseerde dipoolkragte.*
*Waterstofbindings in **D** is sterker as die dipool-dipool kragte in **F**.*
OF
*Dipool-dipool kragte in **F** is swakker as waterstofbindings in **D**.* (3)

4.5.3 Substitution/Halogenation/Chlorination✓
Substitusie/Halogenasie/Chlorinasie (1)

4.5.4

Marking criteria/*Nasienriglyne*:
*Divide by 22,4./*Deel deur 22,4.*✓
*Use of ratio./*Gebruik verhoudings*.✓
*Divide or multiply by 85./*Deel of vermenigvuldig deur 85.*✓
% yield/% opbrengs.*✓
*Final answer./*Finale antwoord.*✓

OPTION/*OPSIE 1*
$n(CH_4) = V/V_m = 26,88/22,4$✓ = 1,2 mol

$n(CH_2C\ell_2)$ = 1,2 mol (Ratio/*Verhouding*)✓
$n(CH_2C\ell_2)$actual/werklike = m/M = $0,043 \times 10^3/85$✓ = 0,506 mol
% Yield = Actual yield/Theoretical yield × 100
% Opbrengs = Werklike opbrengs/Teoretiese opbrengs × 100
= 0,506/1,2 × 100✓
= 42,16%✓

Accepted range/*Aanvaarde wydte*: 42,16 to/*tot* 42,5%

OPTION/*OPSIE 2*
$n(CH_4) = V/V_m = 26,88/22,4$✓ = 1,2 mol
$n(CH_2C\ell_2)$ = 1,2 mol (Ratio)✓
$(CH_2C\ell_2)$ = nM = 1,2 × 85✓ =102 g
% Yield = Actual yield/Theoretical yield × 100
% Opbrengs = Werklike opbrengs/Teoretiese opbrengs × 100
= $0,043 \times 10^3/102 \times 100$✓
= 42,16%✓
Accepted range/*Aanvaarde wydte:* 42,16 to/*tot* 42,5%

OPTION/*OPSIE 3*
$V(CH_2C\ell_2)$ = 26,88dm^3 (Ratio/Verhouding)✓
$n(CH_2C\ell_2)$ = m/M = $0,043 \times 10^3/85$✓ = 0,506 mol
$V(CH_2C\ell_2) = nV_m = 0,506 \times 22,4$✓ = 11,33 dm^3
% Yield = Actual yield/Theoretical yield × 100
%Opbrengs = Werlikeopbrengs/Teoretiese opbrengs
= 11,33/26,88 × 100✓
= 42,16%✓
Accepted range/*Aanvaarde wydte*: 42,16 to/*tot* 42,5% (5)

[19]

QUESTION/*VRAAG* 5

5.1 Exothermic/*Eksotermies* ✓ ΔT is positive/*ΔT is positief*. ✓
OR/OF
T_{final} is higher/*T_{finaal} is hoër* ✓
OR/OF
$T_{initial}$ is lower/*$T_{oorspronklik}$ is laer* ✓ (2)

5.2 Nature of reacting substances./*Aard van reaktante.* ✓ (1)

5.3 EQUAL TO ✓ Same amount of metal used. ✓
GELYK AAN. Dieselfde hoeveelheid metaal gebruik. (2)

5.4 5.4.1 Experiment 2/*Eksperiment 2*✓ (1)

5.4.2 Mg is a stronger reducing agent ✓ than Zn. ✓
Mg is 'n sterker reduseermiddel as Zn. (2)

5.5 Increase in temperature increases kinetic energy of particles. ✓
More particles will have sufficient/enough kinetic energy./$E_a \geq E_k$. ✓
More effective collisions per unit time/second. (Frequency of effective collisions increases). ✓
Toename in temperatuur verhoog kinetiese energie van deeltjies.
Meer deeltjies het voldoende/genoegsame kinetiese energie./$E_a \geq E_k$
Meer effektiewe botsings per eenheidstyd/sekonde. (Frekwensie van effektiewe botsings neem toe.) (3)
[11]

QUESTION/*VRAAG* 6

6.1 Homogeneous/*Homogene* ✓

Reactants and products are in the same phase. ✓
Reaktante en produkte is in dieselfde fase. (2)

6.2 6.2.1 (a) More N_2 added/Increase ✓in $[N_2]$ ✓
Meer N_2 bygevoeg/Toename in $[N_2]$ (1)

(b) Pressure ✓ decreases ✓ (by increase in volume)
Druk neem af (deur toename in volume) (1)

6.2.2 Equal to/*Gelyk aan*✓ (1)

6.3 6.3.1 **Marking Criteria/Nasienriglyne:**
- $n(H_2)$ change = $n(H_2)$ initial - $n(H_2)$ equilibrium. ✓
  $n(H_2)$ verandering = $n(H_2)$ aanvanklik - $n(H_2)$ ewewig
- USE RATIO for $n(N_2)$ change and $n(NH_3)$ change. ✓
  GEBRUIK VERHOUDINGS vir $n(N_2)$verandering en $n(NH_3)$verandering
- n(equilibrium) = n(initial) - n (change) for both $n(N_2)$ and $n(NH_3)$ ✓
  n(ewewig) = n(aanvanklik) – n(verandering) vir beide $n(N_2)$ en $n(NH_3)$
- Divide n(equilibrium) by 1 to calculate c(equilibrium). ✓
  Verdeel n(ewewig) deur 1 om c(ewewig)te bereken.

- Correct K_c expression (formulae in square brackets). ✓
  Korrekte K_c-uitdrukking (formules in vierkant hakies)
- Substitution of K_c value of *1,426 × 10* / *Vervanging van K_c*-waarde *van1,426 × 10^3* . ✓
- Substitution of concentrations into K_c expression. ✓
  Vervanging van konsentrasies in K_c-uitdrukking.
- Calculate n./*Bereken n.* ✓
- *Substitute value for n and 28 for M in n = m/M*
  Vervang waarde van n en 28 vir M in n = m/M ✓
- *Final answer/Finale antwoord* ✓

OPTION/*OPSIE 1*

	N_2	$3H_2$	$2NH_3$
$n_{initial/aanvanklik}$ (mol)	n	n	0
$n_{change/verandering}$ (mol)	0,3n	0,9n	0,6n
$n_{equilibrium/ewewig}$ (mol)	0,7n	0,1n	0,6n
$c_{equilibrium/ewewig}$ (mol·dm^{-3})	0,7n	0,1n	0,6n ✓÷ div by 1

$K_c = [NH_3]^2 / [N_2] [H_2]^3$ ✓
$1,426 \times 10^3$ ✓ $= (0,6n)^2 / (0,7n \times (0,1n)^3$ ✓
$n = 0,6$ mol ✓
$m = n.M$
$= 0,6 \times 28$ ✓
$= 16,8$g ✓

OPTION/*OPSIE 2*: Concentrations/*Konsentrasies* in mol·dm^{-3}

	N_2	$3H_2$	$2NH_3$
$c_{initial/aanvanklik}$ (mol·dm^{-3})	n/1	n/1 ✓ div by 1 ✓	0
$c_{change/verandering}$ (mol·dm^{-3})	0,3n	0,9n ✓	0,6n
$c_{equilibrium/ewewig}$ (mol·dm^{-3})	0,7n	0,1n ✓	0,6n

$K_c = [NH_3]^2 / [N_2] [H_2]^3$ ✓
$1,426 \times 10^3$ ✓ $= (0,6n)^2 / (0,7n \times (0,1n)^3$ ✓
$n = 0,6$ mol ✓
$m = n.M$
$= 0,6 \times 28$ ✓
$= 16,8$g ✓ (10)

6.3.2 K_c Decreases/K_c *neem toe* ✓
Increase in temperature favours the endothermic reaction. ✓
Reverse reaction is favoured ✓ (decreasing $[NH_3]$, increasing $[N_2]$ and $[H_2]$).
Toename in temperatuur bevoordeel die eksotermiese reaksie.
Terugwaartse reaksie is bevoordeel (verminder $[NH_3]$, vermeerder $[N_2]$ en $[H_2]$). (3)
[18]

QUESTION/*VRAAG* 7

7.1 Solution with known concentration. ✓✓
Oplossing waarvan konsentrasie bekend is. (2)

7.2 Improve accuracy of results./Ensuring more accurate results. ✓
Verbeter akkuraatheid van resultate./Versekering meer akkurate lesings. (1)

7.3 $n = cV$ ✓
$= 0,02 \times 25 \times 10^{-3}$ ✓
$= 5 \times 10^{-4}$ mol ✓ (0,0005 mol) (3)

7.4 **POSITIVE MARKING FROM QUESTION 7.3**
POSITIEWE NASIEN VANAF VRAAG 7.3

$n(NaOH) = 2$✓ $\times 5 \times 10^{-4}$ $= 1x10^{-3}$ mol c(NaOH)dilute/*opgelos* = nV $= 1 \times 10^{-3}/19,97 \times 10^{-3}$✓ $= 0,05$ mol·dm^{-3} **OR/OF** c(NaOH)dilute/*opgelos* × Vdilute/*opgelos* = c(NaOH) × V(NaOH) 0,05 × 100✓ = c(NaOH) × 10 ✓ c(NaOH) = 0,5 mol·dm^{-3} $[H_3O^+].[OH^-] = 10^{-14}$ $[H_3O].0,5$✓ $= 10^{-14}$ $[H_3O^+] = 2 \times 10^{-14}$ mol·dm^{-3} pH = -log$[H_3O^+]$✓ = -log 2×10^{-14}✓ = 13,7✓ (accept/*aanvaar* 13,699)	Concentration changes by a factor of/*Konsentrasie verander met 'n faktor van* 100✓/10 = 10 Therefore/*Daarom* c(NaOH) = 0,5 mol·dm^{-3} ✓ pOH = -log$[OH^-]$ ✓ = -log 0,5 ✓ = 0,3 pH + pOH = 14 pH = 14 – 0,3✓ = 13,7✓ (accept/*aanvaar* 13,699)

Marking Criteria/Nasienriglyne:

- Use mole ratio/*Gebruik mol verhouding:* $n(H_2C_2O_4) : n(NaOH) = 1: 2$ ✓
- Substitute volume and number of moles to calculate c(NaOH)dilute. ✓
  Vervang volume en aantal mol om c(NaOH)opgelos te bereken.
- Substitute 100, ✓ value for c(NaOH)dilute and 10. ✓
  c(NaOH)dilute × 100 = c(NaOH) × 10 to calculate c(NaOH) before dilution.
  Vervang 100, waarde van c(NaOH)opgelos en 10 in c(NaOH)opgelos × 100 = c(NaOH) × 10 om c(NaOH) voor oplossing te bereken.
- Formule of pH. ✓*I*Formule van pH.*
- Subsitute c(NaOH)concentrated in $[H_3O^+].[OH^-] = 10^{-14}$ ✓
  Vervang c(NaOH)gekonsentreerd in $[H_3O^+].[OH^-] = 10^{-14}$
- Substitute value for $[H_3O^+]$ in formula for pH.✓
  Vervang waarde vir $[H_3O^+]$ *in formule vir pH.*
- Final answer*I*Finale antwoord*: 13,7 ✓ (accept/*aanvaar* 13,699)

Notes/Aantekeninge:
Wrong formula for pH e.g pH = -log[OH-]; pOH = -log[NaOH]
Verkeerde formule vir bv. pH = -log[OH-]; pOH = -log[NaOH]
No marks for substitution and answer in the pH calculation part.
Geen punte vir substitusie en antwoord in die gedeelte van pH berekening: 5/8 (8)

[14]

QUESTION/*VRAAG* 8

8.1 8.1.1 Provides path for movement of ions./Completes the circuit./Ensures electrical neutrality in cell. ✓
Verskaf n pad vir die beweging van ione./Voltooi die stroombaan./Verseker elektriese neutraliteit van sel. (1)

8.1.2 0 ✓ (V) (1)

8.1.3 Platinum or/of Pt ✓ (1)

8.1.4 Iron(III) ion or Fe^{3+} ✓
Yster(III)-ioon of Fe^{3+} (1)

8.1.5 $Fe^{3+} + e^- \checkmark \rightarrow Fe^{2+} \checkmark$ (2)

8.2 $E^0_{cell/sel} = E^0_{cathode/katode} - E^0_{anode/anode}$ ✓
$0,83 \checkmark = 0,77 \surd - E^0_{anode}$
$E^0_{anode} = -0,06$ ✓ (V)
X is Fe ✓ (Iron/*Yster*) (5)

Notes/*Aantekeninge*:
- Accept any other correct formula from the data sheet./*Aanvaar enige ander korrekte formule vanaf gegewensblad.*
- Any other formula using unconventional abbreviations, e.g. $E^0_{cell} = E^0_{OA} - E^0_{RA}$ followed by the correct substitutions./*Enige ander formule wat onkonvensionele afkortings gebruik, bv.* $E^0_{sell} = E^0_{OM} - E^0_{RM}$ *gevolg deur korrekte vervangings:* 3/4

8.3 ✓ ✓ ✓
Fe / Fe^{3+} // Fe^{2+}, Fe^{3+} / Pt **Accept/ *Aanvaar:*** X / X^{3+} // Fe^{3+}, Fe^{2+} / Pt (3)
[14]

QUESTION/*VRAAG* 9

9.1 9.1.1 Electrolytic/*Elektrolities* ✓

Electrical energy to chemical energy. ✓
Elektriese energie na chemiese energie. (2)

9.1.2 $2H_2O + 2e^- \rightarrow H_2 + 2OH^- \checkmark\checkmark$
Ignore phases/*Ignoreer fases*

Notes/Aantekeninge:

$2H_2O + 2e^- \leftrightharpoons H_2 + 2OH^-$ (1/2)	$H_2 + 2OH^- \leftarrow 2H_2O + 2e^-$ (2/2)
$H_2 + 2OH^- \leftrightharpoons 2H_2O + 2e^-$ (0/2)	$2H_2O + 2e^- \leftarrow H_2 + 2OH^-$ (0/2)

(2)

9.1.3 Cu or/of Copper/*Koper* ✓ (1)

9.1.4 Decreases/*Verminder* ✓

Cu^{2+} (or Copper(II) ions) are reduced ✓ to Cu ✓ (or Copper).
Cu^{2+}(of Koper(II) ione) word gereduseer na Cu (of Koper) (3)

9.2 9.2.1 Set ions free to move./*Stel ione vry om te beweeg.*✓ (1)

9.2.2 Na^+ is a weaker oxidising agent✓ than Al^{3+} ✓ $Al^{3+}$are reduced(to Al). ✓
OR
Al^{3+} is a stronger oxidising agent ✓ than Na^+ ✓. Al^{3+} are reduced (to Al) ✓

Na^+ is 'n sterker oksideermiddel as Al^{3+}. Al^{3+} word gereduseer na Al.
OF
Al^{3+} is 'n sterker oksideermiddel as Na^+. Al^{3+}word gereduseer na Al. (3)
[12]

QUESTION/*VRAAG* 10

10.1 10.1.1 Nitrogen/*Stikstof*✓ (1)

10.1.2 Iron ✓ or Iron oxides
Yster of Ysteroksiede (1)

10.2 n(NO) = m/M= 1,12/28 ✓= 0,04 mol
1 mol NO : 1 mol NO_2
n(NO_2) = 0,04 mol ✓
∆H = -149,1 kJ for every/vir elke 2mol NO
= -149,1 kJ/2mol NO × 0,04 mol NO ✓
= -2,98 kJ ✓

Marking Criteria/*Merkriglyne*:
- Substitute m and M/*Vervang m en M* ✓
- Ratio NO: NO_2/*Verhouding* NO: NO_2 ✓
- Multiply by 0,04 and divide by 2. ✓/*Vermenigvuldig met 0,04 en verdeel deur 2.*
- Final answer/*Finale antwoord:* -2,98 kJ ✓ (4)

10.3 10.3.1 PROTOLYTIC/*PROTOLITIESE*✓ (1)

10.3.2 NH_3 + HNO_3 ✓ → NH_4NO_3 ✓ Bal. ✓

Notes/Aantekeninge:
- Reactants ✓ **Products** ✓ **Balancing** ✓
  Reaktanse P *Produkte* *Balansering*
- Ignore double arrows./*Ignoreer dubbel pyle.*
- Marking rule 6.3.10./*Nasienreël 6.3.10* (3)

10.4 m(N) = 3/11 ✓ × 60/100 × 50 ✓ = 8,18 kg ✓

Marking Criteria/Merkriglyne:
- Multiply by 3/11/*Vermenigvuldig met* 3/11. ✓
- Multiply by 60% and 50/*Vermenigvuldig met* 60% *en* 50 ✓
- Final answer/ *Finale antwoord:* 8,18 kg ✓ (3)

10.5 Eutrophication/*Eutrofikasie* ✓ OR/*OF* Dead zones/Dooie sone ✓ (1)
[14]

TOTAL/*TOTAAL*: 150