



Province of the
EASTERN CAPE
EDUCATION

**NATIONAL
SENIOR CERTIFICATE
NASIONALE SENIOR
SERTIFIKAAT**

GRADE/GRAAD 12

SEPTEMBER 2017

**PHYSICAL SCIENCES P2
FISIESE WETENSKAPPE V2
MEMORANDUM**

MARKS/PUNTE: 150

This memorandum consists of 18 pages.
Hierdie memorandum bestaan uit 18 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 manipulerings 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. $V \cdot m^{-1}$ in plaas van of $N \cdot C^{-1}$, en $cm \cdot s^{-1}$ of $km \cdot h^{-1}$ in plaas 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.*

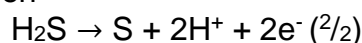
| CORRECT KORREK | ANSWER (1) ANTW. (1) | POSSIBLE MOONTLIK | ANSWER (2) ANTW. (2) | POSSIBLE MOONTLIK |
|--|--|---|---|--|
| $I = \frac{V}{R} \checkmark$ $= \frac{200}{25} \checkmark$ $= 8A \checkmark$ | $R = \frac{V}{I} \checkmark$ $= \frac{200}{25} x$ $= 8A x$ | $R = \frac{V}{I} x$ $= \frac{200}{25}$ $= 8A$ | $R = \frac{V}{I} \checkmark$ $I = \frac{R}{V} x$ $= \frac{25}{200}$ $= 0,125 A x$ | $I = \frac{V}{R} \checkmark$ $= 8A \checkmark$ |

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.

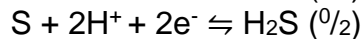
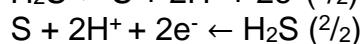
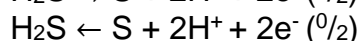
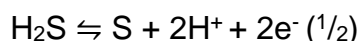
1.5.1 When a chemical **FORMULA** is asked, and the **NAME** is given as answer, only one of the two marks will be awarded. The same rule applies when the **NAME** is asked and the **FORMULA** is given.
Wanneer 'n chemiese FORMULE gevra word en die NAAM word as antwoord gegee, sal slegs een van die twee 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



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:



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 galvaniesesel 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 molekule 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 | D ✓✓ | (2) |
| 1.3 | A ✓✓ | (2) |
| 1.4 | C ✓✓ | (2) |
| 1.5 | C ✓✓ | (2) |
| 1.6 | C ✓✓ | (2) |
| 1.7 | A ✓✓ | (2) |
| 1.8 | B ✓✓ | (2) |
| 1.9 | C ✓✓ | (2) |
| 1.10 | C ✓✓ | (2) |

[20]

QUESTION/VRAAG 2

2.1.1 B ✓ (1)

2.1.2 F ✓ (1)

2.2.1 pentan-2-one ✓✓ /pentan-2-oon

Accept /Aanvaar : 2-pentanone/2-pentanoon

IF/AS pentanone/pentanoon one mark/een punt

(2)

2.2.2 3-bromo-3,4-dimethylhexane/3-broom-3,4-dimietielheksaan

Marking criteria/Nasienriglyne:

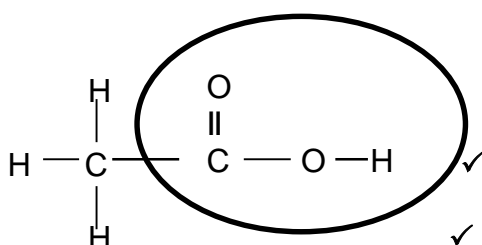
- Correct stem i.e. hexane ✓ | Korrekte stam d.i. heksaan
- First substituent, bromo, correctly identified ✓
Eerste substituent, broom korrek geïdentifiseer.
- Second substituent, dimethyl, correctly identified ✓
Tweede substituent, dimetiel, korrek geïdentifiseer.
- Subtract a mark for missing hyphens, commas, incorrect numbering.
Trek 'n punt af vir enige koppelteken, komma, verkeerde nommering.

(3)

2.3.1 Ester ✓

(1)

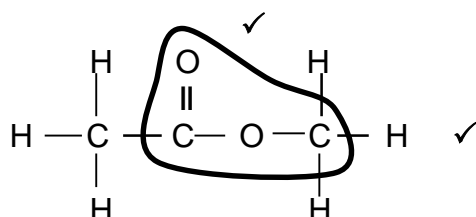
2.3.2

**Marking criteria/Nasienriglyne:**

- Functional group correct./
Funksionele groep korrek 1/2
- Whole structure correct./
Hele struktuur korrek. 2/2

(2)

2.3.3

**Marking criteria/Nasienriglyne:**

- Functional group correct./
Funksionele groep korrek 1/2
- Whole structure correct./
Hele struktuur korrek. 2/2

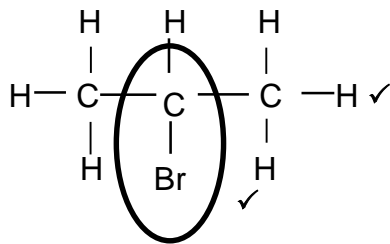
(2)

- 2.4.1 Organic molecules with the same molecular formula ✓ but different structural formulae. ✓
Organiese molekules met dieselfde molekulêre formule, maar verskillende struktuurformules. (2)
- 2.4.2 Ethyl ✓ methanoate ✓ / *Etielmetanoaat* (2)
- 2.5.1 Thermal ✓ / *Termiese* (1)
- 2.5.2 C₄H₁₀ ✓ (1)
- [16]**

QUESTION/VRAAG 3

- 3.1 Secondary ✓ / *Sekondêre* (1)
- 3.2 3.2.1 Substitution ✓ / *Substitusie* (1)
- 3.2.2 Elimination ✓ / *dehydrohalogenation*
Eliminasie / dehidrohalogenering (1)
- 3.2.3 Addition ✓ / *hydration*
Addissie / hidrasie (1)

3.3

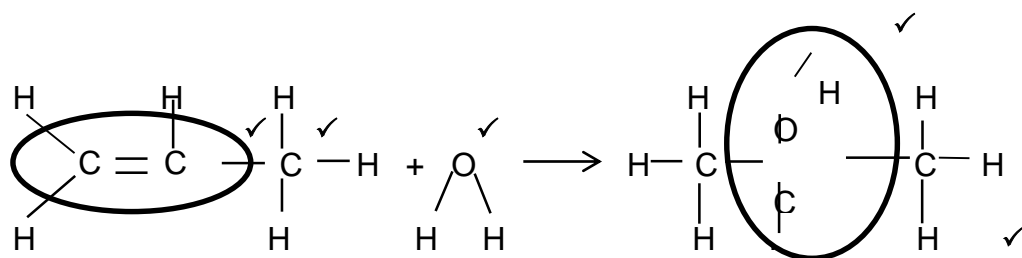


Marking criteria/Nasienriglyne:

- Functional group correct
Funksionele groep korrek. 1/2
- Whole structure correct./
Hele struktuur korrek. 2/2

(2)

3.4

Accept/Aanvaar H₂O

(5)

- 3.5 Concentrated ✓ / *Gekonsentreerd* (1)
- [12]**

QUESTION/VRAAG 4

4.1.1 The pressure exerted by a vapour at equilibrium with its liquid in a closed system. /Die druk uitgeoefen deur 'n damp wat in ewewig met sy vloeistof in 'n geslote sisteem is. ✓✓ (2 OR/OF 0) (2)

4.1.2 Molecular mass (size) ✓/Molekulêre massa (grootte) (1)

4.1.3 E has two sides for hydrogen bonding and F has one OR E forms dimers ✓
E het twee kante vir waterstofbindings en F het een OF E vorm dimere. (1)

4.2.1 **From A to C/Van A na C**

Chain length decreases/surface area decreases/More branches. ✓
Strength of intermolecular forces/London forces/dispersion forces/induced-dipole forces decreases. ✓
Less energy needed to overcome/break intermolecular forces. ✓

*Kettinglengte neem af/oppervlaksarea neem af/Meer vertakkings.
Sterkte van intermolekulêre kragte/London kragte/dispersie kragte/geïnduseerde-dipool kragte neem af.
Minder energie word benodig om die intermolekulêre kragte te oorkom/breek.
OR/OF*

From C to A/Van C na A

Chain length increase/surface area increases/Less branches. ✓
Strength of intermolecular forces /London forces/dispersion forces/induced-dipole forces increases ✓
Less energy needed to overcome/break intermolecular forces increases. ✓

*Kettinglengte neem toe/oppervlaksarea neem toe/Minder vertakkings.
Sterkte van intermolekulêre kragte /London kragte/dispersie kragte/
geïnduseerde-dipool kragte neem toe.
Meer energie word benodig om die intermolekulêre kragte te oorkom/breek. (3)*

4.2.2 Surface area ✓ /Position of side (methyl) chain
Oppervlaks area/ Posisie van sy-(metiel)-ketting (1)

4.2.3 $n(\text{O}_2) = V/V_m$
 $= 96/24 \checkmark$
 $= 4 \text{ mol}$
 \swarrow
 $n(\text{C}_6\text{H}_{14}) = 2/19 \times 4 \checkmark$
 $= 0,42 \text{ mol}$

Marking Criteria/Nasiemriglyne

- Divide by/Verdeel deur 22,4 ✓
- Use ratio/Gebruik verhoudings ✓
- Multiply by/Vermenigvuldig met 4163 ✓
- Final answer/Finale antwoord ✓

Net energy released/ $= 0,42 \times -4163 \checkmark = -1\,748 \text{ kJ/mol} \checkmark$
Netto energie vrygestel

NOTE/NOTA: Accept positive answer/Aanvaar positiewe antwoord.

(4)
[12]

QUESTION/VRAAG 5

5.1.1 (Use zinc) powder ✓ / Increase surface area (of zinc)
(Gebruik *sink*) poeier / Vergroot oppervlakarea (van *sink*) (1)

5.1.2 Increase (temperature) ✓ / Heat
Verhoog (temperatuur)/ Hitte (1)

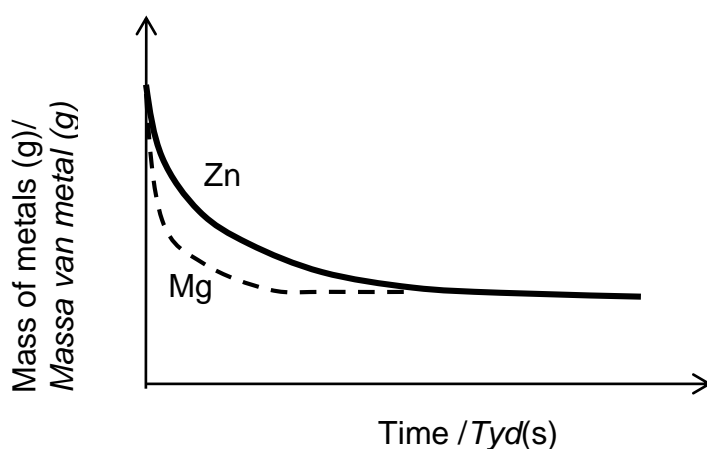
5.2.1 Reaction is complete ✓ / Reaction stops/Zinc is used up/ *Sink is opgebruik.*
Reaksie is volledig (voltooi) / Reaksie stop. (1)

5.2.2 t_1 ✓



Gradient highest ✓ / Steepest gradient
Grootste gradient/ Steilste gradiënt (2)

5.3.1



Criteria for graph Mg/Riglyne vir grafiek Mg

- Shape as shown with a steeper gradient below graph of Zn, starting from the same point and ends at the same point. ✓
Vorm soos aangedui met steiler gradient, onder grafiek van Zn, begin by dieselfde punt en eindig by dieselfde punt. ✓
- Graph becomes horizontal in less time ✓
Grafiek word horisontaal in 'n korter tyd. ✓

(2)

5.3.2 Cu^{2+} is a stronger oxidising agent than H^+ ✓✓ **OR** H^+ is a weaker oxidising agent than Cu^{2+}
 Cu^{2+} is 'n sterker oksideermiddel as H^+ **OF** H^+ is 'n swakker oksideermiddel as Cu^{2+} (2)

5.4.1 Decrease in temperature ✓
Afname in temperatuur (1)

- 5.4.2
- Increase in temperature increases reaction rate. ✓
 - Kinetic energy of particles increases as temperature increases. ✓
 - More particles will have sufficient/enough (kinetic) energy/ $E_k \geq E_A$. ✓
 - More effective collisions per unit time/second. ✓
-
- *Toename in temperatuur verhoog die reaksietempo.*
 - *Kinetiese energie van deeltjies neem toe soos temperatuur toeneem.*
 - *Meer deeltjies het genoegsame (kinetiese) energie/ $E_k \geq E_A$.*
 - *Meer effektiewe botsings per eenheidstyd/sekonde.*

OR/OF

- Decrease in temperature decreases reaction rate ✓
 - Kinetic energy of particles decreases as temperature decreases ✓
 - Less particles will have sufficient/enough (kinetic) energy/ $E_k \geq E_A$. ✓
 - Less effective collisions per unit time/second. ✓
-
- *Afname in temperatuur verlaag die reaksietempo.*
 - *Kinetiese energie van deeltjies neem af as temperatuur verlaag*
 - *Minder deeltjies het genoegsame (kinetiese) energie/ $E_k \geq E_A$.*
 - *Minder effektiewe botsings per eenheidstyd./sekonde.*

(4)

[14]**QUESTION/VRAAG 6**

- 6.1 A reaction is reversible when products can be converted back to reactants. ✓✓
'n Reaksie is omkeerbaar wanneer produkte terug omgeskakel kan word in reagens. (2 or/of 0) (2)
- 6.2.1 Decreases ✓ / *Verminder* (1)
- 6.2.2 Increases ✓ / *Vermeerder* (1)
- 6.3 10^{-3} ✓ (1)

6.4 **Marking Criteria/Nasienglyne:**

- Equilibrium $n(\text{AX}_2) = \text{Equilibrium } c(\text{AX}_2) \times V$ ✓
Ewewig $n(\text{AX}_2) = \text{Ewewig } c(\text{AX}_2) \times V$
- Change in $n(\text{AX}_2) = \text{equilibrium } n(\text{AX}_2) - \text{initial } n(\text{NH}_3)$ ✓
Verandering $n(\text{NH}_3) = \text{ewewig } n(\text{NH}_3) - \text{aanvanklik } n(\text{NH}_3)$
- USE RATIO for change in $n(\text{AX}_2)$ and change in $n(\text{X}_2)$ change. ✓
GEBRUIK VERHOUDINGS vir verandering in $n(\text{AX}_2)$ verandering in $n(\text{X}_2)$.
- $n(\text{equilibrium}) = n(\text{initial}) - n(\text{change})$ for $n(\text{X}_2)$ ✓
 $n(\text{ewewig}) = n(\text{aanvanklik}) - n(\text{verandering})$ vir $n(\text{X}_2)$
- Divide equilibrium $n(\text{X}_2)$ by V to calculate equilibrium $c(\text{X}_2)$. ✓
Verdeel ewewig $n(\text{X}_2)$ deur V om ewewig $c(\text{X}_2)$ te bereken.
- Correct K_c expression (formulae in square brackets). ✓
Korrekte K_c -uitdrukking (formules in vierkant hakies)
- Substitution of concentrations into K_c expression. ✓
Vervanging van konsentrasies in K_c -uitdrukking.
- Final answer/Finale antwoord: $1,84 \text{ dm}^{-3}$ ✓

**POSITIVE MARKING from QUESTION 6.3****POSITIEWE NASIEN vanaf VRAAG 6.3****OPTION/OPSIE 1**

| | 3X_2 | 2AX_2 | |
|---|---------------------------|----------------|----------------------|
| $n_{\text{initial}}(\text{mol})$ $n_{\text{aanvanklik}}(\text{mol})$ | 0,46 | 0 | |
| $n_{\text{change}}(\text{mol})$ $n_{\text{verandering}}(\text{mol})$ | 0,15 V | + 0,1 V ✓ | Ratio ✓ / Verhouding |
| $n_{\text{equilibrium}}(\text{mol})$ $n_{\text{ewewig}}(\text{mol})$ | $0,46 - 0,15 V$ ✓ | 0,1 V ✓ | |
| $c_{\text{equilibrium}}(\text{mol} \cdot \text{dm}^{-3})$ $c_{\text{ewewig}}(\text{mol} \cdot \text{dm}^{-3})$ | $\frac{0,46 - 0,15}{V}$ ✓ | 0,1 | |

$$K_c = [\text{AX}_2]^2 / [\text{X}_2]^3 \checkmark$$

$$10^{-3} = (0,1)^2 / (0,46 / V - 0,15)^3 \checkmark$$

$$V = 0,2 \text{ dm}^{-3} \checkmark$$

OPTION/OPSIE 2

$$K_c = [AX_2]^2 / [X_2]^3 \checkmark$$

$$10^{-3} = (0,1)^2 / [X_2]^3$$

$$[X_2] = 2,15 \text{ mol.dm}^{-3}$$

| | $3X_2$ | $2AX_2$ |
|---|--|----------------------------|
| $n_{\text{initial}}(\text{mol})$ $n_{\text{aanvanklik}}(\text{mol})$ | $2,15 \text{ V} + 0,15 \text{ V} = 0,46$ | 0 |
| $n_{\text{change}}(\text{mol})$ $n_{\text{verandering}}(\text{mol})$ | $\checkmark \left[\begin{array}{l} 0,15 \text{ V} \\ 2,15 \text{ V} \checkmark \end{array} \right.$ | $0,1 \text{ V} \checkmark$ |
| $n_{\text{equilibrium}}(\text{mol})$ $n_{\text{newewig}}(\text{mol})$ | $2,15 \text{ V} \checkmark$ | $0,1 \text{ V} \checkmark$ |
| $C_{\text{equilibrium}}(\text{mol.dm}^{-3})$ $C_{\text{ewewig}}(\text{mol.dm}^{-3})$ | 2,15 | 0,1 |

Ratio/Verhouding \checkmark

$$2,15 \text{ V} + 0,15 \text{ V} = 0,46 \checkmark$$

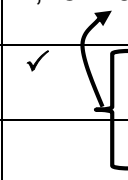
$$\text{V} = 0,2 \text{ dm}^3 \checkmark$$

OPTION/OPSIE 3**USING CONCENTRATIONS/GEBRUIK KONSENTRASIES**

$$K_c = [AX_2]^2 / [X_2]^3 \checkmark$$

$$10^{-3} = (0,1)^2 / [X_2]^3$$

$$[X_2] = 2,15 \text{ mol.dm}^{-3}$$

| | 3X ₂ | 2AX ₂ | |
|-------------------------|--|------------------|--------------------|
| Cinitial Caanvanklik | 2,15 + 0,15 = 2,3 | 0 | |
| Cchange Cverandering | ✓  0,15 | 0,1✓ | Ratio/Verhouding ✓ |
| Cequilibrium Cewewig | 2,15 | 0,1✓ | |

$$c = n/V \checkmark$$

$$2,3 = 0,46 / V \checkmark$$

$$V = 0,2 \text{ dm}^{-3} \checkmark$$

(8)

6.5 Decreases✓/Neem af



- An increase in temperature causes a decrease in K_c . ✓
- When the temperature is increased, the reaction that will oppose this increase in temperature, will be favoured. ✓
- Reverse reaction is favoured by a decrease in temperature. ✓
- 'n Toename in temperatuur veroorsaak 'n afname in K_c .
- Wanneer die temperatuur toeneem, sal die reaksie wat die toename in temperatuur teenwerk, bevoordeel word.
- Die terugwaartse reaksie word bevoordeel deur 'n afname in temperatuur.

OR/OF

- The forward reaction is exothermic. ✓
- An increase in temperature favours the endothermic reaction. ✓
- The reverse reaction is favoured. ✓
- Die voorwaartse reaksie is eksotermies.
- 'n Toename in temperatuur bevoordeel die endotermiese reaksie.
- Die terugwaartse reaksie word bevoordeel.

(4)

[18]

QUESTION/VRAAG 7

7.1.1 Hydrolysis ✓ / *Hidroliese* (1)

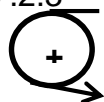
7.1.2 Weak ✓ / *Swak*
 K_b value/waarde is < 1 ✓
 OR/OF
 K_b value is low ✓ / K_b waarde is laag (2)

7.1.3 Acids ✓ / *Sure*
 Both act as proton (H^+) donors ✓ / *Donate protons(H^+)/Lose protons(H^+)*
Beide tree op as proton (H^+) skenkers/Proton(H^+) skenkers/Verloor proton (H^+). (2)

7.2.1 Burette ✓ / *buret* (1)

7.2.2 20 cm^3 ✓ (1)

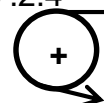
7.2.3 **POSITIVE MARKING from QUESTION 7.2.2/ POSITIEWE NASIEN vanaf VRAAG 7.2.2**



$n = Cv$ ✓

$n(\text{NaOH}) = 0,2 \times 20/1000$ ✓ = $0,004\text{ mol}$ ✓ ($4 \times 10^{-3}\text{ mol}$) (3)

7.2.4 **POSITIVE MARKING FROM QUESTION 7.2.3/ POSITIEWE NASIEN VANAF VRAAG 7.2.3**



$n(\text{H}_2) = \frac{1}{2} (0,004)$ ✓ = $0,002\text{ mol}$ ($2 \times 10^{-3}\text{ mol}$)

$c(\text{H}_2\text{X}) = n / V = 0,002 / (40/1000)$ ✓ = $0,05\text{ mol.dm}^{-3}$

$\text{pH} = -\log[\text{H}_3\text{O}^+]$ ✓ = $-\log(2 \times 0,05)$ ✓ = 1 ✓ (5)

Marking Criteria/Nasien riglyne:

- Use of ratio/*Gebruik verhouding* $\text{NaOH} : \text{H}_2\text{X}$ ✓
- Substitution into $c = n/V$ to calculate $n(\text{H}_2\text{X})$.
Substitusie in $c = n/V$ om $n(\text{H}_2\text{X})$ te bereken. ✓
- Use formule/*Gebruik formule:* $\text{pH} = -\log [\text{H}_3\text{O}^+]$ ✓
- Substitution of $2 \times c(\text{H}_2\text{X})$ into $[\text{H}_3\text{O}^+]$ ✓ /
Substitusie van $2 \times c(\text{H}_2\text{X})$ in $[\text{H}_3\text{O}^+]$
- Final answer/*Finale antwoord* ✓

7.2.5 Neutral ✓ / *Neutraal*



(Titration of) strong base with a strong acid. ✓
(Titrasië van) 'n sterk basis met 'n sterk suur.

(2)
[18]

QUESTION/VRAAG 8

8.1 It is solution/liquid/dissolved substance ✓ that conducts electricity through the movement of ions. ✓
Dit is 'n oplossing/vloeistof/opgeloste stof wat elektrisiteit gelej deur die beweging van ione. (2)

8.2 Positive ✓ / *Positief*



It is the cathode. ✓ / *Dit is die katode.*

OR/OF

It is the electrode where reduction takes place.

Dit is die elektode waar reduksie plaasvind. (2)

8.3.1 1 mol.dm⁻³ ✓ (1)

8.3.2 ✓ ✓ ✓
 Ti (s)/ Ti³⁺ (aq) // Ag⁺ (aq)/ Ag(s) Accept/Aanvaar Ti/ Ti³⁺ // Ag⁺/ Ag (3)

8.4 $E^0_{\text{cell/sel}} = E^0_{\text{cathode/katode}} - E^0_{\text{anode}}$ ✓
 2,43 = 0,80 ✓ - E^0_{anode} ✓
 $E^0_{\text{anode}} = -1,63 \text{ V}$ ✓

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. $E^0_{\text{cell}} = E^0_{\text{OA}} - E^0_{\text{RA}}$
Enige ander formule wat onkonvensionele afkortings gebruik, bv.
 $E^0_{\text{sell}} = E^0_{\text{OM}} - E^0_{\text{RM}}$ *gevolg deur korrekte vervangings:* 3/4

(4)

8.5 3 Mg + 2 Ti³⁺ ✓ ⇌ 3 Mg²⁺ + 2 Ti ✓ ✓ balancing / *balansering*

Reactants ✓
Reagense

Products ✓
Produkte

Balancing ✓
Balansering

Accept single arrow / *Aanvaar enkelpyltjie*

(3)

[17]

QUESTION/VRAAG 9

9.1 Negative ✓ / *Negatief*

9.2 To improve (electrical) conductivity. ✓
Om (elektriese) geleiding te verbeter. (1)

9.3 Decreases ✓ / *Afneem*

Cu → Cu²⁺ + 2e⁻ ✓✓

Ignore phases/Ignoreer fases (3)



$$m(\text{Cu}) = nM = 1(63,5) \checkmark = 63,5 \text{ g}$$

$$\% \text{ Purity} = \frac{m(\text{pure})}{m(\text{impure})} \times 100$$

$$\% \text{ Suiwerheid} = \frac{m(\text{suiwer})}{m(\text{onsuiwer})} \times 100$$

$$m(\text{impure/onsuiwer}) = \frac{63,5 \times 100 \checkmark}{95,7 \checkmark}$$

$$= 66,35 \text{ g} \checkmark$$

(5)
[10]

QUESTION/VRAAG 10

10.1.1 Ammonia \checkmark / Ammoniak (1)

10.1.2 Ostwald(process) \checkmark / Ostwaldt(proses) (1)

10.1.3 NO \checkmark (1)

10.1.4 $\text{HNO}_3 \checkmark$ and/en NO \checkmark (2)

10.1.4 $\text{NH}_3(\text{g}) + \text{HNO}_3(\text{aq}) \checkmark \rightarrow \text{NH}_4\text{NO}_3 \checkmark$ Bal. \checkmark (3)

Notes/Aantekeninge:

- | | | |
|---|---|------------------------|
| • Reactants \checkmark | Products \checkmark | Balancing \checkmark |
| • Reaktante | • Produkte | Balansering |
| • Ignore/Ignoreer | \rightleftharpoons and phases/en fases. | |
| • Marking rule 6.3.10/Nasienreël 6.3.10 | | |

10.2.1 The percentage of fertiliser in the bag \checkmark / The percentage of the primary nutrients (N:P:K) in the bag of fertilizers.
 Die persentasie van kunsmis in die sak / Die persentasie van primêre voedingstowwe (N:P:K) in die sak kunsmis. (1)

10.2.2 Dead zones \checkmark / Dooie sones (1)

10.2.3 $\% \text{ N in } (\text{NH}_4)_2\text{SO}_4 = \frac{2(14)}{132} \times 100 \checkmark = 21,21\%$

$$m(\text{N}) = \frac{21,21}{100} \times 39,6 \checkmark = 8,399 \text{ kg}$$

$$\% \text{ N in bag} = 7/15 \times 36 \checkmark = 16,8\%$$

$$\frac{16,8}{100} \times m = 8,399 \text{ kg} \checkmark$$

$$m = 50 \text{ kg} \checkmark$$

Marking criteria/Nasienriglyne:

- Calculate / Bereken $\% \text{ N in } (\text{NH}_4)_2\text{SO}_4 \checkmark$
- Calculate / Bereken $m(\text{N}) \text{ in } (\text{NH}_4)_2\text{SO}_4 \checkmark$
- $\% \text{ N in bag of fertiliser / in sak kunsmis} \checkmark$
- Calculate mass m / Bereken massa $m \checkmark$
- Final answer / Finale antwoord: 50 kg \checkmark

(5)
[15]

TOTAL/TOTAAL: 150