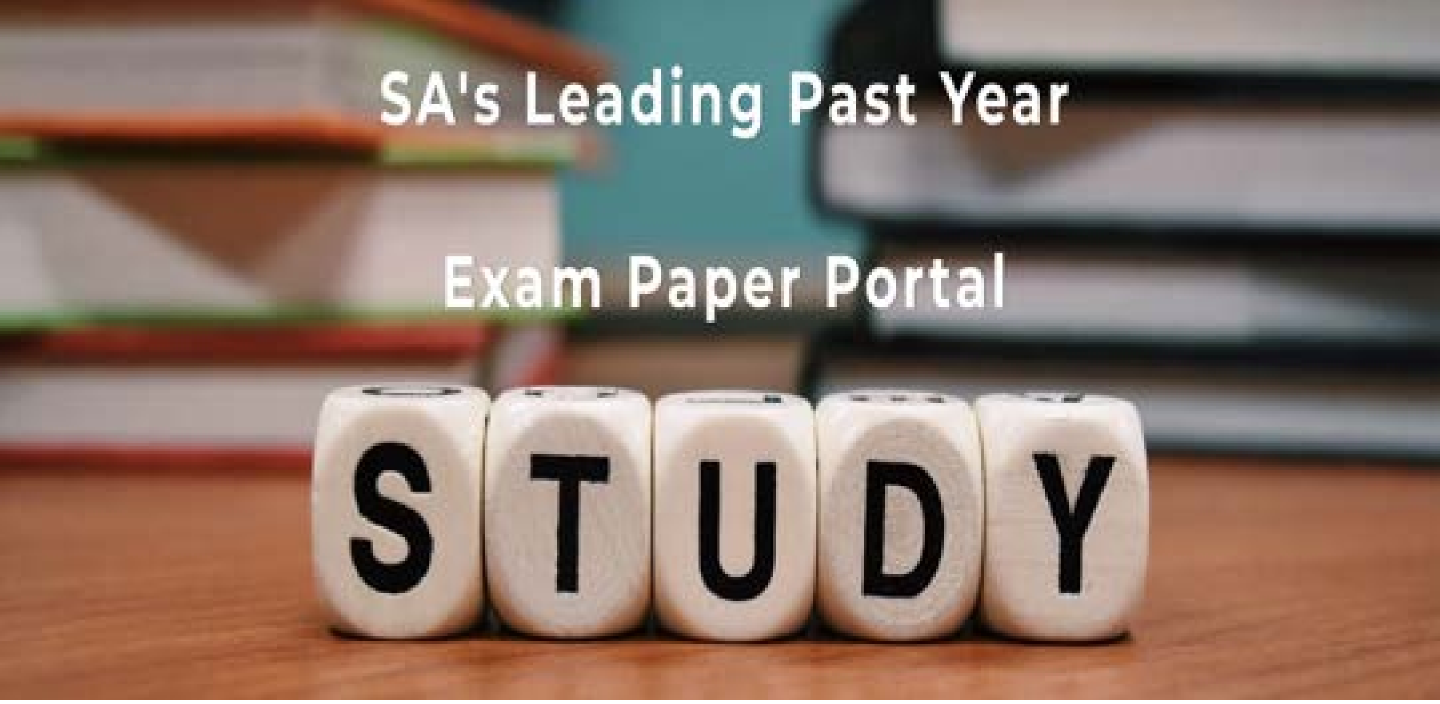


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**GRADE/*GRAAD* 12**

**SEPTEMBER 2019**

# PHYSICAL SCIENCES P2/
# *FISIESE WETENSKAPPE V2*
# (CHEMISTRY/*CHEMIE*)
# MARKING GUIDELINE/*NASIENRIGLYN*

**MARKS/ PUNTE: 150**

This marking guideline consists of 19 pages./
*Hierdie nasienriglyn bestaan uit 19 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 be 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 wetenskaplike konsepte, met betrekking tot die vraag, beklemtoon word.*

### 1.2 FORMULAE AND SUBSTITUTIONS/*FORMULES EN SUBSTITUSIES*

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 has 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 is** om 'n berekening te doen d.w.s. substitusie is gedoen of 'n numerieke antwoord is 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 nie 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 vir Vraestel 1).*

## 1.4 POSITIVE 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 **Subquestion to subquestion**: When a certain variable is calculated in one subquestion (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 subquestion**: 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 is 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 stroombaandiagram-vraag) hoef dieselfde volgorde nie noodwendig gevolg te word 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 nie, sal egter geen punte nie 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 konsepfout, kan 'n verkeerde antwoord nie korrek gemotiveer word nie. As die kandidaat derhalwe met 'n vraag in 3.2 gevra word om die antwoord in vraag 3.1 te motiveer, en 3.1 is verkeerd, sal geen punte vir vraag 3.2 toegeken word nie. As die antwoord in bv. 3.1 egter 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* ***verkeerde beginsel,*** *sal* ***geen punte*** *toegeken word nie (Reël 1) bv. As die potensiaalverskil 200 V en die weerstand 25 Ω is, bereken die stroom*.

| CORRECT<br>*KORREK* | ANSWER (1)<br>*ANTW. (1)* | POSSIBLE<br>*MOONTLIK* | ANSWER (2)<br>*ANTW. (2)* | POSSIBLE<br>*MOONTLIK* |
|---|---|---|---|---|
| $I = \frac{V}{R}$ ✓<br>$= \frac{200}{25}$ ✓<br>$= 8A$ ✓ | $R = \frac{V}{I}$ ✓<br>$= \frac{200}{25}$ ✗<br>$= 8A$ ✗ | $R = \frac{V}{I}$ ✗<br>$= \frac{200}{25}$<br>$= 8A$ | $R = \frac{V}{I}$ ✓<br>$I = \frac{R}{V}$ ✗<br>$= \frac{25}{200}$<br>$= 0{,}125\ A$ ✗ | $I = \frac{V}{R}$ ✓<br>$= 8A$ ✓ |

## 1.5 GENERAL PRINCIPLES OF MARKING IN CHEMISTRY/ *ALGEMENE BEGINSELS BY DIE NASIEN van 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 $E^{\theta}_{cell}$) 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 vir of* $E^{\theta}_{sel}$*) 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 gegalvaniseerde 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 toegeken word 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 struktuurformule 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 verkorte 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 1-penteen skryf 'n kandidaat 1 penteen), sal punte verbeur word.*

## QUESTION 1/*VRAAG 1*

| | | | |
|---|---|---|---|
| 1.1 | D | ✓✓ | (2) |
| 1.2 | B | ✓✓ | (2) |
| 1.3 | C | ✓✓ | (2) |
| 1.4 | A | ✓✓ | (2) |
| 1.5 | A | ✓✓ | (2) |
| 1.6 | B | ✓✓ | (2) |
| 1.7 | D | ✓✓ | (2) |
| 1.8 | C | ✓✓ | (2) |
| 1.9 | B | ✓✓ | (2) |
| 1.10 | D | ✓✓ | (2) |

**[20]**

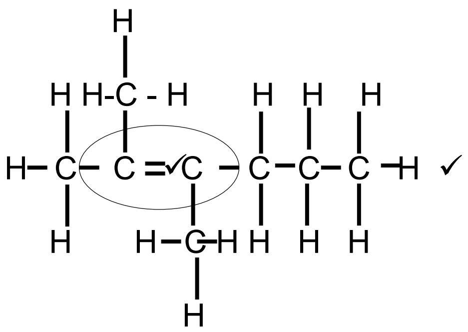
## QUESTION 2/*VRAAG 2*

2.1 Carbon can form four strong covalent bonds.
Carbon can bond with itself to form long chains.
Carbon can have single, double or triple bonds.
Carbon can bond with hydrogen, oxygen, halogen and sulphur atoms.

*Koolstof kan vier sterk kovalente bindings vorm.*
*Koolstof kan met homself verbind om lang kettings te vorm.*
*Koolstof kan enkel-, dubbel- of drievoudige bindings hê.*
*Koolstof kan verbind word met waterstof-, suurstof-, halogeen- en swaelatome.*
(Any two/*Enige twee* ✓✓) (2)

2.2. A bond or an atom or a group of atoms that determine(s) the physical and chemical properties of a group of organic compounds. ✓✓
*'n Binding of 'n atoom of 'n groep atome wat die fisiese en chemiese eienskappe van 'n groep organiese verbindings bepaal.* (2)

2.3 2.3.1



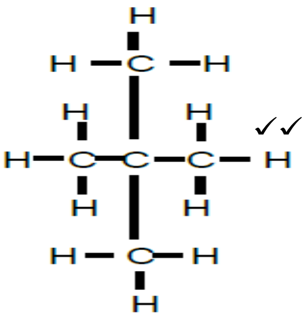
| **Marking criteria/*Nasienriglyne*** |
|---|
| • Whole structure correct 2/2<br>*Volle struktuur korrek 2/2*<br>• Functional group correct ½<br>*Funksionele groep korrek ½* |

(2)

2.3.2 Pentanal ✓✓ (2)

2.4 2.4.1 (Structural) Isomer ✓
*(Struktuur) Isomeer* (1)

2.4.2



| **Marking Criteria/*Nasienriglyne*** | |
|---|---|
| • Whole structure correct | 2/2 |
| *Volle struktuur korrek* | *2/2* |
| • Correct name | 2/2 |
| *Naam korrek* | *2/2* |
| • If only propane correct | 1/2 |
| *Slegs propaan korrek* | *1/2* |

2,2-dimethylpropane ✓✓
*2,2-dimetielpropaan*

(4)
**[13]**

## QUESTION 3/*VRAAG 3*

3.1 The temperature at which the vapour pressure ✓of a liquid equals the atmospheric/external pressure. ✓

*Die temperatuur waarteen die dampdruk ✓van 'n vloeistof gelyk aan die atmosferiese / eksterne druk is.* ✓ (2)

3.2 propan✓-1-ol✓ *Accept* 1-propanol
*propan-1-ol* *Aanvaar 1-propanol* (2)

3.3

| Marking guidelines/Nasienriglyne |
|---|
| • For the same number of carbon atoms alcohols have higher boiling points/ *Vir dieselfde hoeveelheid koolstofatome het alkohole hoër kookpunte*. ✓ |
| • Type of IMF in alcohol/*Tipe IMK in alkohol* ✓ |
| • Type of IMF aldehydes/*Tipe IMK in aldehiede* ✓ |
| • Compare strength of IMFs/*Vergelyk sterkte van IMKe* ✓ |
| • Compare energy required/*Vergelyk energie benodig* ✓ |

For the same number of carbon atoms alcohols have higher boiling points ✓ (than aldehydes)
*Vir dieselfde hoeveelheid koolstofatome het alkohole hoër kookpunte.*
*(as aldehiede)*

Alcohols have hydrogen bonds ✓ while aldehydes have dipole-dipole forces. ✓
*Alkohole het waterstofbindings terwyl die aldehiede dipool-dipool kragte het.*

Hydrogen bonds are stronger✓ (than the dipole-dipole forces)
**OR** Dipole-dipole forces are weaker (than hydrogen bonds)
*Waterstofbindings is sterker (as die dipool-dipool kragte )*
***OF*** *Dipool-dipool kragte is swakker (as waterstofbindings)*

More energy is required to overcome the Intermolecular forces/Hydrogen bonds/bonds in the alcohols. ✓
*Meer energie word benodig om die Intermolekulêre kragte/Waterstofbindings / -bindings in die alkohole te oorkom.* (5)

3.4
- Both (alcohol and carboxylic acid) have (london dispersion forces/induced dipole forces, dipole-dipole forces and) hydrogen bonds. ✓
  *Albei (Alkohol en karboksielsuur) het (London verspreidingskragte / geïnduseerde dipoolkragte, dipool-dipoolkragte en) waterstofbindings.*
- Hydrogen bonds are stronger ✓ in carboxylic acids since
  *Waterstofbindings is sterker ✓ in karboksielsure omdat*
- they have two sites for hydrogen bonding ✓ (while alcohols have one site for hydrogen bonding)
  *hulle het twee plekke vir waterstofbinding (terwyl alkohole een plek het vir waterstofbinding)* (3)

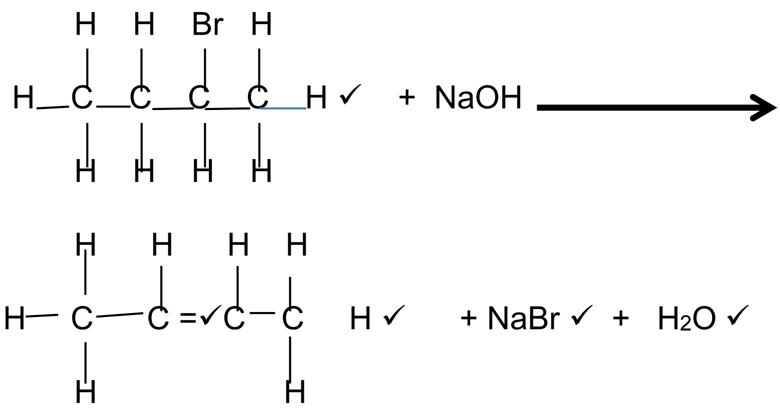
**[12]**

## QUESTION 4/*VRAAG 4*

4.1 4.1.1 Reaction II. ✓
*Reaksie II* (1)

4.1.2 Butan-1-ol ✓✓ *Accept /Aanvaar* 1-butanol (2)

4.1.3




(5)

**Marking Criteria/*Nasienriglyne***
- Reactants ✓
  *Reaktante*
- Organic Product: Whole structure correct 2/2
  *Only functional group correct ½*
  Organiese Produk: Volle struktuur korrek 2/2
  *Slegs funksionele groep korrek ½*
- NaBr ✓
- $H_2O$ ✓

4.2 4.2.1 A/$C_4H_8$ . ✓ The molecule is unsaturated **OR** molecule has a double bond/multiple bond.
*A / $C_4H_8$ . Die molekuul is onversadig **OF** molekuul het 'n dubbelbinding / veelvoudige binding.* (2)

4.2.2 Hydrogen ✓(gas)
*Waterstof (gas)* (1)

4.3 4.3.1 It acts as a catalyst. ✓
*Dit dien as 'n katalisator.* (1)

4.3.2 $CH_3CH_2COOH$ ✓✓OR $CH_3CH_2C(=O)—OH$ (2)

4.3.3 Butyl ✓ propanoate. ✓
*Butiel propanoaat.* (2)

4.3.4 (The distinct) ester smell. ✓
*(Die kenmerkende) ester reuk* (1)
**[17]**

## QUESTION 5/*VRAAG 5*

5.1 The change in concentration (of reactants or products) per unit time. ✓✓
*Die verandering in konsentrasie (van reaktanse of produkte) per eenheidstyd.*
**OR/*OF***
Change in amount OR mass OR volume (of product or reactant) per unit time
*Verandering in hoeveelheid OF massa OF volume (van produk of reaktant) per eenheidstyd.*
Rate of change in concentration/amount/number of moles/volume/mass.
Tempo van verandering in kosentrasie/hoeveelheid/getal mol/volume/massa. (2)

5.2 $0{,}67 = \frac{v-0}{60-0}$ ✓✓

$v = 40{,}2\ cm^3$ ✓ (3)

5.3 120 s. ✓ The gradient of the graph is zero after 120 s. ✓
*Die gradiënt van die grafiek is nul na 120 s.*
**OR/*OF***
The volume of $H_2$ gas remains constant after 120 s. ✓
*Die volume $H_2$ gas bly konstant na 120 s.*
**OR/*OF***
No more $H_2$ gas is produced after 120 s. ✓
*Geen $H_2$ gas word na 120 s geproduseer nie.*
**OR/*OF***
One of the reactants is used up.
*Een van die reaktante is opgebruik.* (2)

5.4

**Mg**

$n = \frac{m}{M}$

$n = \frac{0,048}{24}$ ✓

$n = 2 \times 10^{-3}$ mol

Any one/*Enige een* ✓

**HCℓ**

$c = \frac{n}{v}$

$1 = \frac{n}{10 \times 10^{-3}}$ ✓

$n = 10 \times 10^{-3}$ mol

Mole: HCℓ : Mg

2 : 1

n (HCℓ) = 2 n (Mg)

n (HCℓ) = 2 ($2 \times 10^{-3}$ ) ✓

n (HCℓ) = $4 \times 10^{-3}$ mol required/ *benodig*

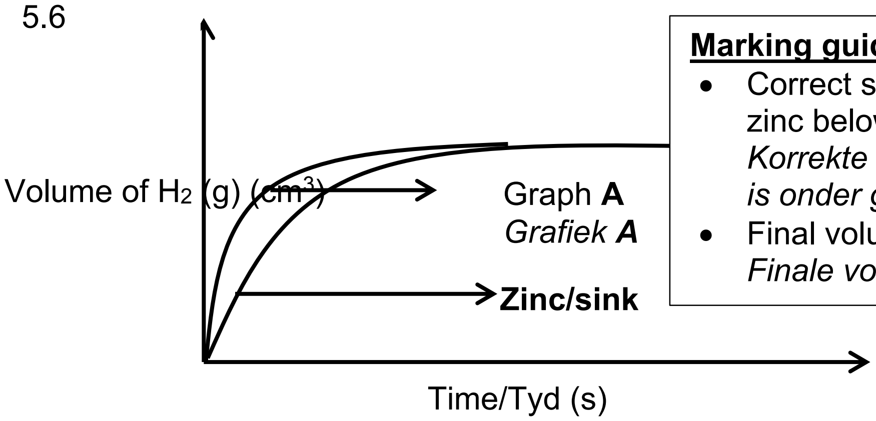
Therefore HCℓ is in excess./ *Daarom is HCℓ in oormaat.*

| | |
|---|---|
| $n_{left/oor} = n_{original/oorspronglik} - n_{reacting/reageer}$<br>$n_{left/oor} = (10 \times 10^{-3}) - (4 \times 10^{-3})$ ✓<br>$n_{left/oor} = 6 \times 10^{-3}$ mol<br><br>m = nM<br>$m = (6 \times 10^{-3})(36,5)$ ✓<br>m = 0,219 g ✓ (0,22g) | $v = \frac{n}{c}$<br>$v = \frac{4 \times 10^{-3}}{1}$<br>$v = 4 \times 10^{-3}$ $dm^3$<br>$V_{left/oor} = V_{original/oorspronglik} - V_{reacting/reageer}$<br>$V_{left/oor} = (10 \times 10^{-3}) - (4 \times 10^{-3})$ ✓<br>$V_{left/oor} = 6 \times 10^{-3}$ $dm^3$<br>m = cMV<br>$m = (1)(36,5)(6 \times 10^{-3})$ ✓<br>m = 0,219 g ✓ (0,22g) |

(7)

5.5 Number of collisions with correct orientation increases ✓
*Aantal botsings met korrekte oriëntasie verhoog*
More effective collisions per unit time ✓/Frequency of effective collisions increases
*Effektiewe botsings per eenheidstyd / Frekwensie van effektiewe botsings styg* (2)

5.6




**Marking guideline/Nasienriglyne**

- Correct shape with graph of zinc below graph A ✓
  *Korrekte vorm van grafiek sink is onder grafiek A*
- Final volume the same ✓
  *Finale volume dieselfde*

(2)
**[18]**

## QUESTION 6/*VRAAG 6*

6.1 6.1.1 Equal to ✓
*Gelyk aan* (1)

6.1.2 Higher than ✓
*Hoër as* (1)

6.2 Increases ✓✓
*Verhoog* (2)

6.3

**<u>Marking Criteria/*Nasienriglyne*</u>**

- $[H_2]$ first equilibrium
  *$[H_2]$ eerste ewewig*
- $[I_2]$ second equilibrium
  *$[I_2]$ tweede ewewig*
- Ratio
  *Verhouding*
- [HI] second equilibrium
  *[HI] tweede ewewig*
- Kc expression
  *Kc uitdrukking*
- Substitution into Kc expression
  *Substitusie in Kc uitdrukking*
- Final answer
  *Finale antwoord*

Range/*Gebied*: $1,93 \times 10^{-2}$ to/tot $1,96 \times 10^{-2}$

**<u>OPTION 1/*OPSIE 1*</u>**

**CALCULATION USING CONCENTRATIONS/**
***BEREKEN DEUR KONSENTRASIES***

**Notes/*Notas***
No Kc expression 6/7
*Geen Kc uitdrukking 6/7*
Wrong Kc expression 4/7
*Verkeerde Kc uitdrukking 4/7*

| | 2HI | $H_2$ | $I_2$ |
|---|---|---|---|
| $c_i$ | 0,72 | 0,026✓ | 0,026 |
| Δc | 0,116 | 0,058 | 0,058 |
| $c_{equilibrium}$ | 0,604✓ | 0,084 ✓ | 0,084 |

✓Ratio/*Verhouding*

$Kc = [H_2].[I_2]/[HI]^2$✓

$= 0,084^2/0,604^2$✓

$= 1,93 \times 10^{-2}$ ✓ Range/*Gebied*: $1,93 \times 10^{-2}$ to/tot $1,96 \times 10^{-2}$ (7)

**OPTION 2/*OPSIE 2***

**CALCULATION USING MOLES/*BEREKEN DEUR MOL TE GEBRUIK***

| | 2HI | $H_2$ | $I_2$ |
|---|---|---|---|
| | | | |
| $c_i$ | 0,72V | 0,026V✓ | 00,026V |
| | | | |
| Δc | 0,116 V | 0,058 | 0,058V |
| | | | |
| $c_{equilibrium}$ | 0,604V✓ | 0,084 V | 0,084V✓ |

✓Ratio/*Verhouding*

$Kc = [H_2]\cdot[I_2]/[HI]^2$ ✓

$= (0,084\ V)^2/(0,604\ V)^2$ ✓

$= 1,93 \times 10^{-2}$ ✓ Range/*Gebied*: $1,93 \times 10^{-2}$ to/*tot* $1,96 \times 10^{-2}$

6.4 INCREASES/ ✓
*TOENEEM* (1)

**[12]**

## QUESTION 7/*VRAAG 7*

7.1 7.1.1 Weak acids <u>ionise incompletely in water</u> ✓✓ to form a low concentration of $H_3O^+$ ions. ✓✓
*Swak sure <u>ioniseer onvolledig in water</u> om 'n lae konsentrasie $H_3O^+$-ione te vorm* (2)

7.1.2 Base/ ✓
*Basis* (1)

7.1.3 $In^-$✓ (1)

7.2 7.2.1 Burette ✓
*Buret* (1)

7.2.2 PINK TO COLOURLESS ✓
*PIENK NA KLEURLOOS*

Adding ethanoic acid increases $[H_3O^+]$ ✓
*Die addisie van etanoësuur verhoog $[H_3O^+]$*
The reaction that consumes $H_3O^+$ is favoured ✓
*Die reaksie wat $H_3O^+$ gebruik word bevoordeel.*
The reverse reaction is favoured ✓
*Die omgekeerde reaksie word bevoordeel*
**OR** Equilibrium position shifts to the left
Die omgekeerde reaksie word bevoordeel
**OF** Ewewigsposisie skuif na links (4)

7.2.3

**OPTION 1/*OPSIE 1***

$[H_3O^+][OH^-] = 1\times10^{-14}$
$[H_3O^+](0,1) = 1\times10^{-14}$ ✓
$[H_3O^+] = 1\times10^{-13}\ mol\cdot dm^{-3}$
$pH = -log[H_3O^+]$ ✓
$pH = -\log(1\times10^{-13})$ ✓
pH =13 ✓

**OPTION 2/*OPSIE 2***

$[NaOH] = [OH^-] = 0,1\ mol\cdot dm^{-3}$ ✓
$pOH = -log[OH^-]$
$pOH = -log(0,1)$
pOH=1
pH + pOH = 14 ✓
pH + 1 = 14 ✓
pH = 13 ✓ (4)

7.2.4 **OPTION 1/*OPSIE 1***

$n_{NaOH}$ = cV✓
= 0,1 x (0,018)✓
= 1,8 x $10^{-3}$ mol
$n_{\text{Dilute Ethanoic acid/ verdunde etanoësuur}}$ = 1,8 x $10^{-3}$ mol✓

$c_{\text{Dilute Ethanoic acid/ verdunde etanoësuur}}$ = 1,8 x $10^{-3}$/0.02 = 0,09 mol.dm$^{-3}$
$c_{\text{Undiluted Vinegar}}$ =10 ✓x 0,09 mol·dm$^{-3}$
= 0,9 mol·dm$^{-3}$
= 0,09 mol/ 100cm$^3$

m ($_{\text{in 100 cm3 undiluted vinegar}}$)= nM
=0,09 x 60
= 5,4 g✓ in 100 cm$^3$
NOT TRUE/ONWAAR ✓

**OPTION 2/*OPSIE 2***

$$\frac{c_a v_a}{c_b v_b} = \frac{n_a}{n_b}✓$$

$$\frac{(0,1)(18)}{c_a(20)✓}✓ = \frac{1}{1}✓$$

$c_a$ = 0,09 mol·dm$^{-3}$

**OPTION 3/*OPSIE 3***

$n_{NaOH}$ = cV ✓
= 0,1 x 0.018 ✓
= 1,8 x $10^{-3}$ mol
$n_{\text{Dilute Ethanoic acid}}$= 1,8 x $10^{-3}$ mol ✓

$c_{\text{Dilute Ethanoic acid}}$ =1,8 x $10^{-3}$×0.02 = 0,09 mol.dm$^{-3}$
$c_{\text{Undiluted Vinegar}}$ = 10 ✓x 0,09 mol·dm$^{-3}$
= 0,9 mol·dm$^{-3}$
= 0,09 mol/ 100cm$^3$

$n = \frac{m}{M}$

$n = \frac{5,80}{60}$

$n = 0,097\ mol\ per\ 100cm^3$ ✓
NOT TRUE ✓
*ONWAAR*

**OPTION 4/*OPSIE 4***

$n_{(NaOH)}$ = cv✓
$n_{(NaOH)}$ =(0,1)(0,018) ✓
$n_{(NaOH)}$ = 0,0018 mol ✓

NaOH:$CH_3COOH$
n($CH_3COOH$)= 0,0018 mol

$c = \frac{n}{v}$

c = $\frac{0,0018}{0,02}$

c = 0,09 mol·dm$^{-3}$
$c_1V_1 = c_2V_2$

$c_1$(0,01) = (0,09)(0,1) ✓
$c_1$ = 0,9 mol·dm$^{-3}$

c = $\frac{m}{MV}$

0,9 = $\frac{m}{(60)(0,1)}$ ✓

m = 5,4 g in 100 cm$^3$ ✓
NOT TRUE ✓ / *ONWAAR*

(8)
**[21]**

## QUESTION 8/*VRAAG 8*

8.1 Completes the cell ✓
*Voltooi die sel*
Keep the two half-cells neutral ✓
*Hou die twee halfselle neutraal*
Keeps the reactants separate to allow for indirect transfer of electrons. ✓
*Hou die reaktante afsonderlik om toe te laat vir indirekte oordrag van elektrone.*
(Any TWO/*Enige TWEE*) (2)

8.2 Half-cell A ✓
*Halfsel A* (1)

8.3 $2Fe + 3Br_2$ ✓ → $2Fe^{3+} + 6Br^-$ ✓ ✓ Bal. (3)

**Notes/*Notas***
- Reactants ✓ Products ✓ Balancing ✓
  *Reaktante Produkte Balansering*
- Ignore double arrows
  *Ignoreer dubbelpyltjies*
- Marking rule 6.3.10/*Nasienriglyne 6.3.10*

8.4 $E^\theta_{cell} = E^\theta_{cathode} – E^\theta_{anode}$ ✓
$E^\theta_{cell} = (1,07)$ ✓ $– (- 0,06)$ ✓
$E^\theta_{cell} = 1,13$ V ✓

Notes/*Notas*
- Accept any other correct formula from the data sheet
  *Aanvaar enige ander korrekte formule vanaf datablad.*
- Any other formula using unconventional abbreviations e.g. $E^o_{cell} = E^o_{OA} – E^o_{RA}$ ¾
  *Enige ander formule met onkonvensionelle afkortings bv $E^o_{cell} = E^o_{OA} – E^o_{RA}$ ¾*

(4)

8.5 Lower ✓ $Br_2$ is a stronger oxidising agent ✓ than $I_2$. ✓
*Laer $Br_2$ is 'n sterker oksideermiddel as $I_2$.* (3)
**[13]**

## QUESTION 9/*VRAAG 9*

9.1 Electrical energy✓ is converted to chemical energy. ✓
*Elektriese energie word na chemiese energie omgeskakel* (2)

9.2 When AC is used polarity of the electrodes will change continuously.
*Wanneer WS gebruik word verander die polariteit van die elektrodes voortdurend*

**OR/*OF***

DC ensures polarity of electrodes remains the same
*DC verseker dat polariteit van elektrodes dieselfde bly*
(Any ONE/*Enige EEN*.) ✓✓ (2)

9.3 $Cu^{2+}$ + $2e^-$✓ → Cu ✓ (2)

**Notes/*Notas***

$Cu^{2+} + 2e^- \rightleftharpoons Cu$ ½ $Cu \leftarrow Cu^{2+} + 2e$ 2/2
$Cu \rightarrow Cu^{2+} + 2e^-$ 0/2 $Cu \rightleftharpoons Cu^{2+} + 2e$ 0/2

9.4 Hydrogen ✓
*Waterstof* (1)

9.5 $H_2O$ is a stronger oxidising ✓agent than $Na^+$. ✓ $H_2O$ is reduced to $H_2$ ✓
*$H_2O$ is 'n sterker oksideermiddel as $Na^+$. $H_2O$ word na $H_2$ gereduseer* (3)
**[10]**

## QUESTION 10/*VRAAG 10*

10.1 10.1.1 Fractional distillation of liquid air ✓
*Fraksionele distillasie van vloeibare lug* (1)

10.1.2 Ammonia ✓✓
*Ammoniak* (2)

10.1.3 $NH_3 + HNO_3$ ✓ ⟶ $NH_4NO_3$ ✓ ✓Bal. (3)

10.1.4 Nitrogen ✓
*Stikstof* (1)

10.2 10.2.1 Bag/*Sak* **A** ✓
(It contain the) highest ratio of nitrogen ✓ which promotes the growth of green leaves. ✓
*(Dit bevat die) grootste verhouding van stikstof wat groei van groen blare bevorder.* (3)

10.2.2

| OPTION 1/OPSIE 1 | OPTION 2/OPSIE 2 |
|---|---|
| %N = $\frac{18}{54} \times \frac{30}{100}$ ✓<br>% N = 0,1<br>Mass/*Massa*(N) = 50×0,1 ✓<br>Mass/*Massa* (N) = 5 kg ✓ | Mass/*Massa* (N) = $\frac{18}{54} \times \frac{50}{1} \times$ ✓ $\frac{30}{100}$ ✓<br>Mass/*Massa* (N) = 5 kg |

(3)

10.3 Over fertilisation can lead to eutrophication.
*Oorbevrugting kan tot eutrofikasie lei.*
Rootburn/*Wortelbrand*
(Any relevant answer/*Enige relevante antwoord* ✓) (1)

**[14]**

**TOTAL/*TOTAAL*: 150**

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