education

Department of Education
FREE STATE PROVINCE

# PREPARATORY EXAMINATION
# *VOORBEREIDENDE EKSAMEN*

## GRADE/*GRAAD* 12

# PHYSICAL SCIENCES: CHEMISTRY (P2)
# *FISIESE WETENSKAPPE: CHEMIE (V2)*

## SEPTEMBER 2026

## MARKS/*PUNTE*: 148

## UPDATED MARKING GUIDELINES
## *NASIENRIGLYNE*

**These marking guidelines consist of 15 pages.**
***Hierdie nasienriglyne bestaan uit 15 bladsye.***

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## QUESTION 1/*VRAAG 1*

1.1 B ✓✓ (2)

1.2 D ✓✓ (2)

1.3 D ✓✓ (2)

1.4 B ✓✓ (2)

1.5 C ✓✓ (2)

1.6 A ✓✓ (2)

1.7 B ✓✓ (2)

1.8 C ✓✓ (2)

1.9 B ✓✓ (2)

1.10 A ✓✓ (2)

**[20]**

## QUESTION 2/*VRAAG 2*

2.1.1 E ✓ and/*en* A ✓ (2)

2.1.2 D ✓ (1)

2.1.3 E ✓
**Accept/*Aanvaar***: A (1)

2.2.1 $C_nH_{2n+1}OH$ ✓
**Accept/*Aanvaar***: $C_nH_{2n+2}O$ (1)

2.2.2 Tertiary (alcohol)/*Tersiêr (alkohol)* ✓ (1)

2.2.3

**Marking criteria:**
- Correct stem, i.e. hexanol ✓
- Correct substituents (dimethyl) identified ✓
- IUPAC name completely correct, including numbering, sequence, hyphens and commas ✓

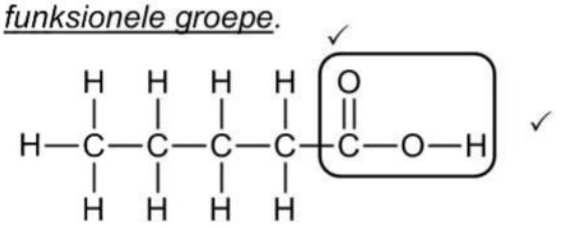
**IF:** 'an' omitted, deduct 1 mark

***Nasienkriteria:***
- *Korrekte stam, d.i. heksanol*
- *Substituente (dimetiel) korrek geïdentifiseer*
- *IUPAC-naam volledig korrek, insluitend nommering, volgorde, koppeltekens en kommas*

***INDIEN:*** *'an' weggelaat word, trek 1 punt af.*

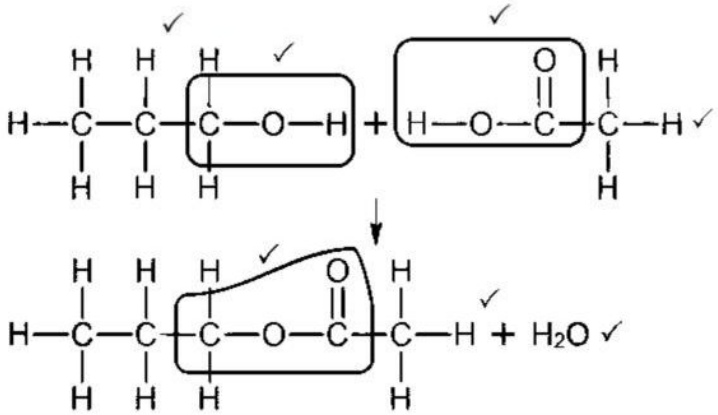
3,4-dimethylhexan-3-ol/3,4-dimethyl-3-hexanol ✓✓✓
*3,4-dimetielheksan-3-ol / 3,4-dimetiel-3-heksanol* (3)

2.3.1 Compounds with the same molecular formulae, ✓ but different functional groups. ✓
*Verbindings met dieselfde molekulêre formule, maar verskillende funksionele groepe.* (2)

2.3.2 


**Marking criteria/Nasienriglyne:**
- Whole structure correct/*Hele struktuur korrek:* $^{2}/_{2}$
- Only functional group correct/*Slegs funksionele groep korrek:* $^{1}/_{2}$

**ACCEPT/*AANVAAR:***
-OH is condensed / *gekondenseerd* (2)

2.3.3 


**Notes/*Aantekeninge*:**
- Ignore/*Ignoreer* ⇌
- Any additional reactants and/or products :
  *Enige addisionele reaktanse en/of ander produkte:* Max./*Maks.* $^{6}/_{7}$
- Condensed or semi-structural formulae:
  *Gekondenseerde of semi-strukturele formules:* Max./*Maks.* $^{4}/_{7}$
- Molecular formulae:
  *Molekulêre formules:* Max./*Maks.* $^{1}/_{7}$

(7)

2.4

**Marking criteria/Nasienriglyne:**
- Correct stem, i.e., hexyne/*Korrekte stam d.i. heksyn* ✓
- Correct substituent (ethyl) correctly identified
  *Korrek geïdentifiseerde substituent (etiel)* ✓
- IUPAC name is completely correct, including numbering, sequence, hyphens and commas
  *IUPAC-naam is volledig korrek, insluitend nommering, volgorde, koppeltekens en kommas* ✓

4-ethylhex-2-yne/4-ethyl-2-hexyne/*4-etielheks-2-yn / 4-etiel-2-heksyn* (3)

2.5 $CH_3CH_2COCH_3$ ✓✓ OR/*OF* $CH_3COCH_2CH_3$ (**2 or/*of* 0**) (2)

**[25]**

## QUESTION 3/*VRAAG 3*

3.1

**Marking criteria/*Nasienkriteria*:**
If any of the underlined key phrases in the correct context are omitted, deduct 1 mark.
*Indien enige van die onderstreepte sleutelfrases in die korrekte konteks weggelaat word, trek 1 punt af.*

The pressure exerted by vapour at equilibrium with its liquid in a closed system. ✓✓
*Die druk wat deur damp uitgeoefen word wanneer dit in ewewig is met sy vloeistof in 'n geslote sisteem.* (2)

3.2 A ✓
**Accept/*Aanvaar*** butane/*butaan* (1)

3.3 (Compound A) has the lowest boiling point ✓✓
*(Verbinding A) het die laagste kookpunt* (2)

3.4.1
- Between butane/Compound A molecules are London forces. ✓
- Between propanal/Compound B molecules are dipole-dipole forces (and London forces). ✓
- Dipole-dipole forces are stronger than London forces. ✓

**OR**

London forces are weaker than dipole-dipole forces.

**OR**

Intermolecular forces between propanal (B) molecules are stronger than those between butane (A).

**OR**

Intermolecular forces between butane (A) molecules are weaker than those between propanal (B).

- More energy is needed to overcome/break the intermolecular forces between propanal molecules. ✓

**OR**

Less energy is needed to overcome/break the intermolecular forces between butane molecules.

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- *Tussen butaan/Verbinding A-molekules is daar London-kragte.*
- *Tussen propanal/Verbinding B-molekules is daar dipool-dipoolkragte (en London-kragte).*
- *Dipool-dipoolkragte is sterker as London-kragte.*

**OF**

*London-kragte is swakker as dipool-dipoolkragte.*

**OF**

*Intermolekulêre kragte tussen propanal (B)-molekules is sterker as dié tussen butaan (A)-molekules.*

**OF**

*Intermolekulêre kragte tussen butaan (A)-molekules is swakker as dié tussen propanal (B)-molekules.*

- *Meer energie is nodig om die intermolekulêre kragte tussen propanal-molekules te breek.*

**OF**

*Minder energie is nodig om die intermolekulêre kragte tussen butaan molekules te breek.* (4)

3.4.2 **Only using compound D**

- Larger surface area/longer chain length/less compact ✓
- Stronger intermolecular forces ✓
- More energy is needed to break intermolecular forces ✓

**OR**

**Only using compound C**

- Smaller surface area/shorter chain length/more compact
- Weaker intermolecular forces
- Less energy needed to break intermolecular forces

**OR**

**From C to D**

- Increase in surface area/chain length/becomes less compact
- Increase in the strength of intermolecular forces
- More energy needed to break the intermolecular forces

**OR**

**From D to C**

- Decrease in surface area/chain length/becomes more compact
- Decrease in strength of intermolecular forces
- Less energy needed to break intermolecular forces

***Slegs met verbinding D***

- *Groter oppervlak/langer kettinglengte/minder kompak*
- *Sterker intermolekulêre kragte*
- *Meer energie benodig om die intermolekulêre kragte te breek*

***Slegs met verbinding C***

- *Kleiner oppervlak/korter kettinglengte/meer kompak*
- *Swakker intermolekulêre kragte*
- *Minder energie benodig om die intermolekulêre kragte te breek*

***OF***

***Vanaf C na D***

- *Toename in oppervlak/kettinglengte/word minder kompak*
- *Toename in die sterkte van intermolekulêre kragte*
- *Meer energie benodig om die intermolekulêre kragte te breek*

***OF***

***Vanaf D na C***

- *Afname in oppervlak/kettinglengte/word meer kompak*
- *Afname in die sterkte van intermolekulêre kragte*
- *Minder energie benodig om die intermolekulêre kragte te breek* (3)

**[12]**

## QUESTION 4/*VRAAG 4*

4.1.1 Substitution/halogenation/chlorination ✓
*Substitusie/halogenasie/chlorering* (1)

4.1.2 Elimination/cracking/*Eliminasie/kraking*✓ (1)

4.2.1 Butane/*Butaan* ✓✓ (2)

4.2.2 $2C_4H_{10} + 13O_2$ ✓ ⟶ $8CO_2 + 10H_2O$ ✓ bal. ✓

**Marking criteria/*Nasienkriteria:***

- Reactants ✓ Products ✓ Balancing: ✓
  *Reaktanse* *Produkte* *Balansering*
- Ignore double arrows./*Ignoreer dubbelpyle.*
- Marking rule 6.3.10/*Nasienreël 6.3.10.*
- Ignore phases./*Ignoreer fases.*

**IF/*INDIEN*:**

Structural formula for $C_4H_{10}$ Max. $\frac{2}{3}$
*Struktuur formule vir $C_4H_{10}$* : Maks.

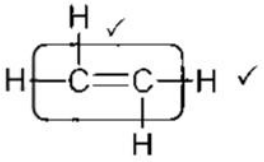
Equal sign instead of arrow: Max. $\frac{2}{3}$
*Gelykaanteken ipv pyl: Maks.*

- Multiples of *balancing coefficients: Max.* $\frac{2}{3}$
  *Veelvoude van balanseerkoëffisiënte: Maks.*

(3)

4.3

**Marking criteria/*Nasienriglyne*:**
- Whole structure correct/*Hele struktuur korrek*: $^2/_2$
- Only functional group correct: $^1/_2$
  *Slegs funksionele groep korrek:*



✓ ✓

**Notes/Notas:**
- Condensed or semi-structural formula:
  *Gekondenseerde of semi-strukturele formule:*
  Max./*Maks.* $^1/_2$
- Molecular formula:
  *Molekulêre formule:* Max./*Maks.* $^0/_2$

(2)

4.4 Chlorine (gas)/*Chloor- (gas)* ✓✓ (2)

**[11]**

**QUESTION 5/*VRAAG 5***

5.1.1 $\underline{4NH_3(g) + 5O_2(g)}$ ✓ → $\underline{4NO(g) + 6H_2O(g)}$ ✓ (2)

5.1.2 **POSITIVE MARKING FROM QUESTION 5.1.1**
***POSITIEWE NASIEN VANAF VRAAG 5.1.1***

Rate/*Tempo* $(H_2O) = \frac{3}{2}(0,3)$ OR/*OF* $\frac{6}{4}(0,3)$ ✓

$= 0,45\ (mol \cdot dm^{-3} \cdot s^{-1})$ ✓ (2)

5.1.3 Yes/*Ja* (1)

5.1.4 Increase in pressure:
- The same number of particles is now confined to a smaller space/increase in number of moles of gas per volume/increase in concentration. ✓
- More particles per unit volume. ✓
- More effective collisions per (unit) time. ✓

- *Toename in druk – dieselfde aantal deeltjies is nou in 'n kleiner ruimte ingeperk/dit verhoog die aantal mol gas per volume/toename in konsentrasie.*
- *Meer deeltjies per volume-eenheid.*
- *Meer effektiewe botsings per tydseenheid.* (3)

5.2.1

**Marking criteria/Nasienkriteria:**
- Both independent and dependent variables identified ✓
  *Beide onafhanklike en afhanklike veranderlikes*
- Correct question about relationship between independent and dependent variables ✓
  *Korrekte vraag oor die verband tussen onafhanklike en afhanklike veranderlikes*

**Example**: What is the relationship between surface area/state of division and the rate of reaction?

**IF**: the question has dependent and independent variables correct, but can be answered with a yes or no, award only 1 mark for correct identification of variables.

***Voorbeeld**: Wat is die verband tussen oppervlak/toestand van verdeeldheid en die reaksietempo?*

***INDIEN**: die vraag die afhanklike en onafhanklike veranderlikes korrek het, maar kan met 'n ja of nee beantwoord word, gee slegs 1 punt vir korrekte identifikasie van die veranderlikes.* (2)

5.2.2 Rate/*Tempo* $= \frac{\Delta V}{\Delta t}$

$13{,}8 = \frac{\Delta V}{50}$ ✓

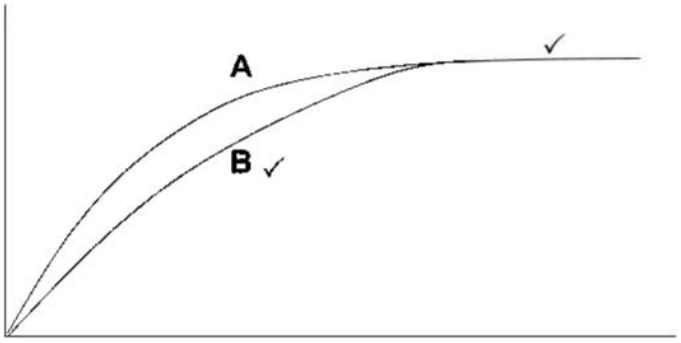
$V = 690\ cm^3$ ✓

The learner is incorrect/*Die leerder is nie korrek nie* ✓ (3)

5.2.3 Less than/*Minder as* ✓ (1)

5.2.4 Decrease in gradient/slope/*Afname in gradiënt/helling* ✓✓ (2)

5.2.5




(2)

**Marking criteria/*Nasienkriteria*:**
- B at lower rate than A/*B teen laer tempo as A* ✓
- Graphs reach the same final volume/*Grafieke bereik dieselfde finale volume* ✓
- If no graph is labelled/ *Indien geen grafiek benoem is nie* Max./*Maks.* $^0/_2$.

5.2.6

**Marking criteria/*Nasienriglyne:***

(a) Formula/*Formule* $n = \frac{V}{Vm}$/ $m = nM$ ✓

(b) Correctly substituting/*Korrekte vervanging* 0,855 and/*en* 24 ✓

(c) Correct ratio/*Korrekte verhouding* $n(H_2):n(Mg)$ ✓

(d) Substitution of/*Vervanging van* 24 in $n = \frac{m}{M}$ ✓

(e) Subtraction: initial mass(Mg) – used mass(Mg) ✓
*Aftrekking: aanvanklike massa (Mg) – gebruikte massa (Mg)*

(f) Final answer/*Finale antwoord:* 1,04 – 1,15 g ✓

$n(H_2)$ produced/*gevorm* $= \frac{V}{Vm}$

$= \frac{0,855}{24}$ ✓ OR/*OF* $\frac{855}{24000}$

ANY/*ENIGE* ✓

$= 0,0356$ mol

$n(Mg) = n(H_2) = 0,0356$ mol ✓

$m(Mg)_{used/gebruik} = nM$

$= (0,0356)(24)$ ✓

$= 0,855$ g

$m(Mg)_{remaining/wat\ oorbly} = 2 - 0,855$ ✓

$= 1,145$ g ✓

(6)
**[24]**

## QUESTION 6/*VRAAG 6*

6.1 (When) the rate of the forward reaction is equal to the rate of the reverse reaction/ (when) the concentration of reactants and products is constant. **(2 or 0)** ✓✓
*(Wanneer) die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie/(wanneer) die konsentrasie van reaktante en produkte konstant is.* (2)

6.2

**Marking criteria/*Nasienriglyne*:**
- Formula/*Formule* pH = -log $[H_3O^+]$/pH = -log $[H^+]$/$[H_3O^+] = 10^{-pH}$ ✓
- Substitution of/*Vervanging van* 3,2 in pH = -log $[H_3O^+]$ ✓
- Correct Kc expression/*Korrekte Kc uitdrukking* ✓
- Substitution of equilibrium concentrations into correct Kc expression and final answer marks removed (volume not given)
  *Punte vir substitusie van ewewigskonsentrasies in korrekte Kc-uitdrukking en finale antwoord verwyder (volume nie gegee nie).*

pH = -log $[H_3O^+]$ ✓
✓ 3,2 = -log $[H_3O^+]$/$[H_3O^+] = 10^{-3,2}$

$[H_3O^+] = 6,30957 \times 10^{-4}\ mol \cdot dm^{-3}$

$$K_C = \frac{[H_3O^+][CH_3COO^-]}{[CH_3COOH]}$$ ✓ (3)

6.3 Decreases/*Afneem* ✓ (1)

6.4 Addition of $CH_3COOH$ will cause an <u>increase in concentration or amount of $H_3O^+$</u> ✓
*Addisie van $CH_3COOH$ sal 'n <u>toename in konsentrasie of hoeveelheid van $H_3O^+$</u> veroorsaak.*
pH decreases/*verminder* ✓✓ (3)

6.5

**Marking criteria/*Nasienriglyne*:**
Exothermic reaction curve/ *Eksotermiese reaksie kurwe*:

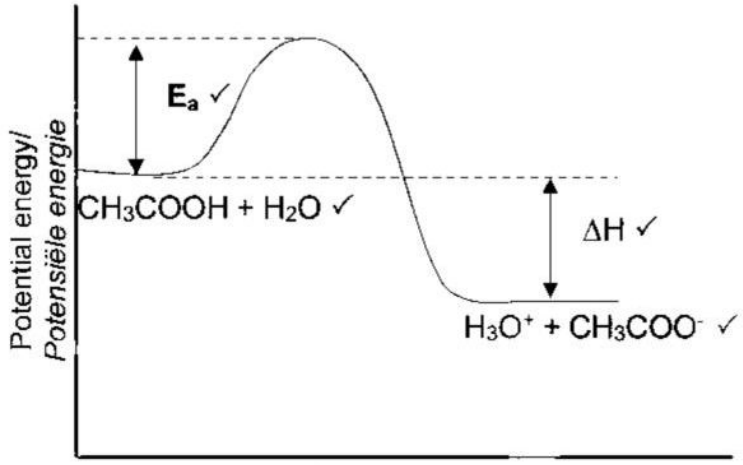
- $CH_3COOH + H_2O$ correctly shown at energy of reactants/*korrek getoon by energie van reaktante* ✓
- $H_3O^+ + CH_3COO^-$ correctly shown at energy of products/*korrek getoon by energie van produkte* ✓
- Activation energy ($E_a$) of reactants correctly shown/*Aktiveringsenergie (Ea) van reaktante korrek getoon* ✓
- Heat of reaction ($\Delta H$) correctly shown/*Reaksiewarmte (ΔH) korrek getoon* ✓

**IF:**

Endothermic reaction curve drawn, deduct $E_a$ and $\Delta H$ mark: Max. $^2/_4$

***INDIEN*:**

*Endotermiese reaksie kurwe geteken is, trek Ea en ΔH punt af: Maks.* $^2/_4$




(4)
**[13]**

## QUESTION 7/*VRAAG 7*

7.1.1 The reaction of an acid with a base ✓ to form a salt and water ✓
*Die reaksie van 'n suur met 'n basis om 'n sout en water te vorm* (2)

7.1.2 A = Burette/*Buret* ✓ (1)

7.1.3 Methyl orange/*Metiel oranje* ✓ (1)

7.1.4 Reaction of strong acid and weak base/ Solution is acidic/Colour change is in pH range less than 7/The endpoint of this titration is within pH range in which indicator changes colour. ✓✓

*Reaksie van sterk suur en swak basis/ Oplossing is suur/Kleurverandering is in 'n pH-reeks minder as 7/Die eindpunt van hierdie titrasie is binne die pH-reeks waarin die indikator van kleur verander.* (2)

7.2.1

**Marking criteria/*Nasienriglyne*:**

a) Formula/*Formule*: $n = cV$/ $n = \frac{m}{M}$ ✓
b) Substitution of/Vervanging van 0,1 ✓ and 0,01 ✓
c) Ratio/*Verhouding* $n(H_2SO_4):n(Na_2CO_3) = 1 : 1$ ✓
d) $n(Na_2CO_3)_{initial} = n(Na_2CO_3)_{reacted} \times \frac{500}{25}$ ✓
e) $m(Na_2CO_3)_{pure} = n(Na_2CO_3)_{initial} \times 286$ ✓
f) 10g – (e) ✓
g) Final answer/*Finale antwoord:* 4,28 g ✓

$$c = \frac{n}{V} \checkmark$$
$$0,1 \checkmark = \frac{n}{0,01} \checkmark$$
$$n(H_2SO_4) = 0,001 \text{ mol}$$

$$n(Na_2CO_3)_{reacted} = n(H_2SO_4)$$
$$= 0,001 \text{ mol} \checkmark$$

$$n(Na_2CO_3)_{initial} = 0,001 \times \frac{500}{25} \checkmark$$
$$= 0,02 \text{ mol}$$

$$m(Na_2CO_3)_{pure} = nM$$
$$= 0,02 \times 286 \checkmark$$
$$= 5,72 \text{ g}$$

$$m_{impurities} = 10 - 5,72 \checkmark$$
$$= 4,28 \text{ g} \checkmark$$

(8)

7.2.2 **POSITIVE MARKING FROM QUESTION 7.2.1**
***POSITIEWE NASIEN VANAF VRAAG 7.2.1***

$$\% Na_2CO_3 = \frac{5,72}{10} \checkmark \times 100 \checkmark$$
$$= 57,2 \% \checkmark$$

(3)

**[17]**

## QUESTION 8/*VRAAG 8*

8.1.1 Chemical (energy) to electrical (energy) **(2 or 0)** ✓✓
*Chemiese (energie) na elektriese (energie)* (2)

8.1.2 Potassium nitrate/*Kaliumnitraat* $KNO_3$
Any soluble salt/*enige oplosbare sout* ✓ (1)

8.2 X ✓
$Cu^{2+}$/copper (II) ion is reduced **OR** $Cu^{2+}$/copper (II) ion is a stronger oxidising agent. ✓
*Die $Cu^{2+}$/koper(II)-ioon word gereduseer **OF** die $Cu^{2+}$/koper(II)-ioon is 'n sterker oksideermiddel.* (2)

8.3.1 $A\ell \rightarrow A\ell^{3+} + 3e^-$ ✓✓

**Marking criteria/*Nasienkriteria:***
- $A\ell \rightleftharpoons A\ell^{3+} + 3e^-$ $\frac{1}{2}$ $A\ell^{3+} + 3e^- \rightleftharpoons A\ell$ $\frac{0}{2}$
  $A\ell^{3+} + 3e^- \rightarrow A\ell$ $\frac{0}{2}$ $A\ell^{3+} + 3e^- \leftarrow A\ell$ $\frac{2}{2}$
- Ignore if charge omitted on electron/*Ignoreer as lading op elektron weggelaat is*
- If charge (+) omitted on/*Indien lading (+) weggelaat word op* $A\ell^{3+}$/:
  Max./*Maks:* $\frac{1}{2}$
  Example/*Voorbeeld*: $A\ell \rightarrow A\ell^{3} + 3e^-$

(2)

8.3.2 $\overset{\checkmark}{A\ell\,(s)}\,|\,\overset{\checkmark}{A\ell^{3+}\,(aq)}\,||\,\overset{\checkmark}{Cu^{2+}(aq)}\,|\,\overset{\checkmark}{Cu(s)}$

**OR/*OF***

$A\ell(s) \mid A\ell^{3+}(1\ mol{\cdot}dm^{-3}) \parallel Cu^{2+}(1\ mol{\cdot}dm^{-3}) \mid Cu(s)$

**OR/*OF***

$A\ell \mid A\ell^{3+} \parallel Cu^{2+} \mid Cu$ (3)

8.4 **OPTION/*OPSIE* 1**

$E^{\theta}_{cell} = E^{\theta}_{reduction} - E^{\theta}_{oxidation}$ ✓
$= 0,34$ ✓ $- (- 1,66)$ ✓
$= 2$ V ✓

$E^{\theta}_{sel} = E^{\theta}_{reduksie} - E^{\theta}_{oksidasie}$
$= 0,34 - (- 1,66)$
$= 2$ V

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

**OPTION/*OPSIE* 2**

| | | |
|---|---|---|
| ✓ | $A\ell \rightarrow A\ell^{3+} + 3e^-$ | +1,66 (V) ✓ |
| | $Cu^{2+} + 2e^- \rightarrow Cu$ | +0,34 (V) ✓ |
| | $2A\ell + 3Cu^{2+} \rightarrow 2\,A\ell^{3+} + 3Cu$ | 2 V ✓ |

(4)

8.5.1 Increase/*Toeneem* ✓ (1)

8.5.2 Concentration of $Cu^{2+}$ increases ✓
*Konsentrasie $Cu^{2+}$ neem toe*
**OR/*OF***
Forward reaction is favoured.
*Die voorwaartse reaksie word bevoordeel.* (1)
**[16]**

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## QUESTION 9/*VRAAG 9*

9.1 Electroplating/decomposition (of copper (II) chloride) ✓✓
*Elektroplatering/ontbinding (van koper(II)chloried)* (2)

9.2 Electrode/*Elektrode* A ✓ (1)

9.3 Electrode/*Elektrode* B ✓ (1)

9.4 $Cu \rightarrow Cu^{2+} + 2e^-$ ✓✓

**Marking criteria/*Nasienkriteria*:**

- $Cu \rightleftharpoons Cu^{2+} + 2e^-$ $\frac{1}{2}$ $Cu^{2+} + 2e^- \rightleftharpoons Cu$ $\frac{0}{2}$
  $Cu^{2+} + 2e^- \rightarrow Cu$ $\frac{0}{2}$ $Cu^{2+} + 2e^- \leftarrow Cu$ $\frac{2}{2}$
- Ignore if charge omitted on electron/*Ignoreer as lading op elektron weggelaat is*
- If charge (+) omitted on/*Indien lading (+) weggelaat word op* $Cu^{2+}$/:
  Max./*Maks:* $\frac{1}{2}$

  Example/*Voorbeeld*: $Cu \rightarrow Cu^2 + 2e^-$

(2)

9.5

**Marking criteria/*Nasienriglyne*:**

(a) Formula/*Formule* $n = \frac{m}{M}$ ✓
(b) Substituting 10 and 63,5 in/*Vervang 10 en **63,5** in* $n = \frac{m}{M}$ ✓
(c) Using ratio/*Gebruik verhouding*: $n(Cu) : n(e^-) = 1:2$ ✓
(d) Final answer/*Finale antwoord* = 0,52 ✓

$$n = \frac{m}{M} \checkmark$$
$$= \frac{16,5}{63,5} \checkmark$$
$$= 0,2598 \text{ (mol)}$$

$$n(e^-) = 2n(Cu)$$
$$= 2 \times 0,2598 \checkmark$$
$$= 0,52 \text{ mol} \checkmark$$

(4)
**[11]**

**TOTAL/*TOTAAL*: 150**