



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

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

NOVEMBER 2013

MEMORANDUM

MARKS/PUNTE: 150

**This memorandum consists of 15 pages.
*Hierdie memorandum bestaan uit 15 bladsye.***

SECTION A/AFDELING A

QUESTION 1/VRAAG 1

- 1.1 Fractional distillation / Fraksionele distillasie ✓ (1)
- 1.2 Dehydration / *Dehidratering* / *Dehidrasie* ✓ (1)
- 1.3 Collision (theory) / Botsings(teorie) ✓ (1)
- 1.4 Reducing agent / Reduseermiddel ✓ (1)
- 1.5 Homologous series / Homoloë reeks ✓ (1)
- [5]**

QUESTION 2/VRAAG 2

- 2.1 C ✓✓ (2)
- 2.2 C ✓✓ (2)
- 2.3 A ✓✓ (2)
- 2.4 D ✓✓ (2)
- 2.5 B ✓✓ (2)
- 2.6 C ✓✓ (2)
- 2.7 A ✓✓ (2)
- 2.8 D ✓✓ (2)
- 2.9 B ✓✓ (2)
- 2.10 C ✓✓ (2)
- [20]**

TOTAL SECTION/TOTAAL AFDELING A: 25

SECTION B/AFDELING B

QUESTION 3/VRAAG 3

3.1
3.1.1 A ✓
C ✓ (2)

3.1.2 B ✓ (1)

3.1.3 F ✓ (1)

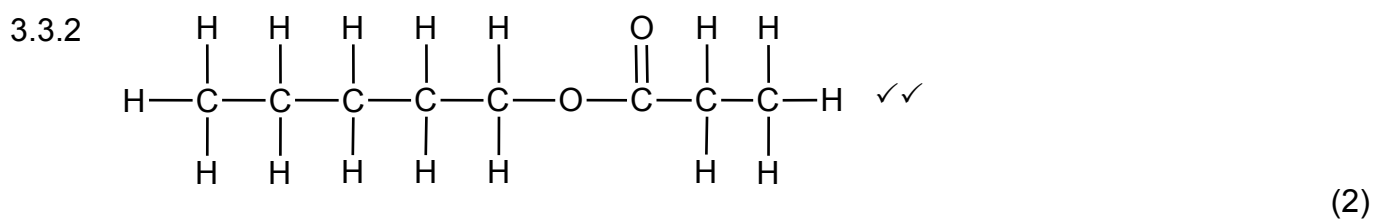
3.1.4 F ✓✓ (2)

3.2
3.2.1 4,5-dimethyl ✓ hex-2-ene ✓ / 4,5-dimetiesel ✓ heks-2-ene ✓
OR/OF
4,5-dimethyl ✓ -2-hexene ✓ / 4,5-dimetiesel ✓ -2-hekseen ✓ (2)

3.2.2 2,3-dibromo-5-methyl ✓ heptane ✓ / 2,3-dibromo-5-metiesel ✓ heptaan ✓ (2)

3.2.3 4-methyl ✓ pent-2-yne ✓ / 4-metieselpent-2-yn
OR/OF
4-methyl ✓ -2-pentyne ✓ / 4-metieselpent-2-yn (2)

3.3
3.3.1 Esters ✓ (1)




3.3.3 Propanoic acid / Propanoësuur ✓ (1)

3.3.4 Sulphuric acid / Swawelsuur / H₂SO₄ ✓ (1)

[17]

QUESTION 4/VRAAG 4

- 4.1
- 4.1.1 Samples / Contents of bottle / (Type of) compound / functional group / homologous series ✓
Monsters / Inhoud van bottel / (Tipe) verbinding / funksionele groep / homologe reeks (1)
- 4.1.2 Boiling point / *Kookpunt* ✓ (1)
- 4.2 ... comparable molecular mass. / ... vergelykbare molekulêre massa. ✓
- OR/OF**
- ... under the same conditions ... / ... onder dieselfde toestande ... (1)
- 4.3
- 4.3.1 Q ✓ (1)
- 4.3.2 R ✓ (1)
- 
- 4.3.3
- R has the highest boiling point. / *R het die hoogste kookpunt.* ✓
 - In addition to weak Van der Waals forces, alcohols also have strong hydrogen bonds between molecules. ✓
Bo en behalwe swak Van der Waalskragte, het alkohole ook sterk waterstofbindings tussen molekule. (2)

4.4 Higher than ✓



• **Structure:**

Longer chain length. / More C atoms in chain. / Greater molecular size. / Greater molecular mass. / Larger surface area. ✓

• **Intermolecular forces:**

Stronger or more intermolecular forces / Van der Waals forces / dispersion forces / London forces. ✓

• **Energy:**

More energy needed to overcome or break intermolecular forces / Van der Waals forces / dispersion forces / London forces. ✓

Hoër as



• **Struktuur:**

Langer kettinglengte. / Meer C-atome in ketting. / Groter molekule. / Groter molekulêre massa. / Groter reaksieoppervlakte.

• **Intermolekulêre kragte:**

Sterker of meer intermolekulêre kragte / Van der Waalskragte / dispersiekragte / Londonkragte.

• **Energie:**

Meer energie benodig om intermolekulêre kragte / Van der Waalskragte / dispersiekragte / Londonkragte te oorkom of breek.

OR/OF

Higher than ✓



• **Structure:**

Pentane has a shorter chain length. / Less C atoms in chain. / Smaller molecular size. / Smaller molecular mass. / Smaller surface area. ✓

• **Intermolecular forces:**

Weaker or less intermolecular forces / Van der Waals forces / dispersion forces / London forces. ✓

• **Energy:**

Less energy needed to overcome or break intermolecular forces / Van der Waals forces / dispersion forces / London forces. ✓

Hoër as



• **Struktuur:**

Pentaan het 'n korter kettinglengte. / Minder C-atome in ketting. / Kleiner molekule. / Kleiner molekulêre massa. / Kleiner reaksieoppervlakte.

• **Intermolekulêre kragte:**

Swakker of minder intermolekulêre kragte / Van der Waalskragte / dispersiekragte / Londonkragte.

• **Energie:**

Minder energie benodig om intermolekulêre kragte / Van der Waalskragte / dispersiekragte / Londonkragte te oorkom of breek.

(4)
[11]

QUESTION 5/VRAAG 5

5.1 Alkenes / Alkene ✓ (1)

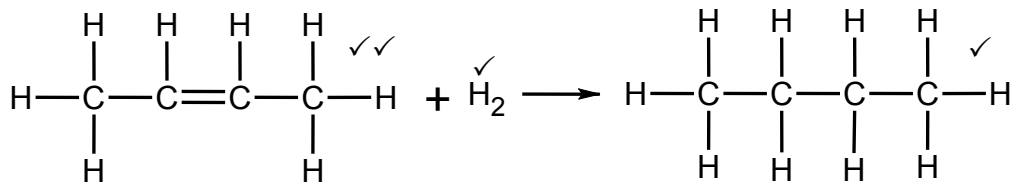
5.2
5.2.1 $C_4H_{10} + Cl_2 \checkmark \rightarrow C_4H_9Cl + HCl \checkmark$ Bal. ✓ (3)

5.2.2 Halogenation / Substitution / Chlorination ✓
Halogenering / Halogenasie / Substitusie / Chlorinering (1)

5.2.3 Heat **OR** (sun)light (UV) / hf ✓
*Hitte **OF** (son)lig (UV) / hf* (1)

5.3
5.3.1  (2)

5.3.2 But-2-ene / 2-butene ✓✓
But-2-een / 2-buteen (2)

5.3.3  (4)

5.3.4 Hydrogenation / Addition ✓
Hidrogenering / Hidrogenasie / Addisie (1)

[15]

QUESTION 6/VRAAG 6

- 6.1
- 6.1.1 (Type of) catalyst / (Tipe) katalisator ✓ (1)
- 6.1.2 Rate (of reaction) / (Reaksie)tempo ✓ (1)
- 6.2 R ✓
- Fastest rate. / Steepest (initial) gradient or slope. / Produces oxygen faster/est / reaches completion faster OR fastest OR in a shorter time ✓
Vinnigste tempo. / Steilste (aanvanklike) gradiënt of helling./ Produseer suurstof vinnigste/er/ bereik voltooiing vinnigste OF vinniger OF in 'n korter tyd. ✓ (2)
- 6.3
- A catalyst provides an alternative pathway of lower activation energy. ✓
'n Katalisator voorsien 'n alternatiewe pad van laer aktiveringsenergie.
 - More molecules have sufficient/enough kinetic energy. / Meer molekule het voldoende/genoeg kinetiese energie. ✓
OR/OF
More molecules have kinetic energy equal to or greater than the activation energy.
Meer molekule het kinetiese energie gelyk aan of groter as die aktiveringsenergie.
 - More effective collisions per unit time. / Rate of effective collisions increases.
Meer effektiewe botsings per eenheidstyd./ Tempo van effektiewe botsings neem toe. ✓ / (3)
- 6.4
- Average rate/Gemiddelde tempo = $\frac{\Delta[\text{H}_2\text{O}_2]}{\Delta t}$
= $\frac{0,0131 - 0,020}{400 - (0)}$ ✓
= $- 1,73 \times 10^{-5} \text{ mol} \cdot \text{dm}^{-3} \cdot \text{s}^{-1}$ ✓
OR/OF
 $1,73 \times 10^{-5} \text{ mol} \cdot \text{dm}^{-3} \cdot \text{s}^{-1}$ (3)
-
- 6.5 - Less than / Kleiner as ✓
- The concentration of hydrogen peroxide decreases as the reaction proceeds. ✓
Die konsentrasie van die waterstofperoksied verminder soos wat die reaksie verloop. (2)

6.6

Mark allocation/Punttoekenning:

- $c = \frac{n}{V}$ or/of $n = \frac{m}{M}$ or/of $c = \frac{m}{MV}$ ✓
- Substitute / Vervang (0,0200 - 0,0106) and/en 50×10^{-3} ✓
- $n(\text{O}_2) = \frac{1}{2}n(\text{H}_2\text{O}_2)$ ✓
- Using/Gebruik $M = 32$ in $m = nM$ or/of cMV or/of a ratio calculation / 'n verhouding berekening' ✓
- Final answer/Finale antwoord: $7,52 \times 10^{-3} \text{ g}$ / 0,008 g / 0,01 g ✓

OPTION 1/OPSIE 1

$$c = \frac{n}{V} \checkmark$$

$$(0,0200 - 0,0106) = \frac{n}{50 \times 10^{-3}} \checkmark$$

$$\therefore n = 4,7 \times 10^{-4} \text{ mol}$$

$$n(\text{O}_2) = \frac{1}{2}n(\text{H}_2\text{O}_2) = \frac{1}{2}(4,7 \times 10^{-4}) \checkmark$$

$$= 2,35 \times 10^{-4} \text{ mol}$$

$$n(\text{O}_2) = \frac{m}{M}$$

$$2,35 \times 10^{-4} = \frac{m}{32} \checkmark$$

$$\therefore m(\text{O}_2) = 7,52 \times 10^{-3} \text{ g}$$

$$= (0,008 \text{ g}) = (0,01 \text{ g}) \checkmark$$

OPTION 2/OPSIE 2

$$\Delta c(\text{H}_2\text{O}_2) = 0,0200 - 0,0106$$

$$= 0,0094$$

$$\Delta c(\text{O}_2) = \frac{1}{2}\Delta c(\text{H}_2\text{O}_2)$$

$$= \frac{1}{2}(0,0094) \checkmark$$

$$= 0,0047$$

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

$$\Delta m(\text{O}_2) = cMV$$

$$= (0,0047)(32) \checkmark (50 \times 10^{-3})$$


$$= 7,52 \times 10^{-3} \text{ g}$$

$$= 0,008 \text{ g}$$

$$= 0,01 \text{ g} \checkmark$$

(5)
[17]

QUESTION 7/VRAAG 7

- 7.1  Low / Laag ✓
Small K_c value. / Klein K_c -waarde. ✓
 K_c is smaller than 1 / K_c is kleiner as 1 (2)

7.2 **CALCULATIONS USING NUMBER OF MOLES:**
BEREKENINGE WAT GETAL MOL GEBRUIK:

Mark allocation/Punttoekenning:

- **USING** ratio/**GEBRUIK** verhouding: $N_2 : O_2 : NO = x : x : 2x$ ✓
- Equilibrium/Ewewig: $n(N_2) = \text{initial/aanvanklik} - \text{change/verandering}$ } ✓
- Equilibrium/Ewewig: $n(O_2) = \text{initial/aanvanklik} - \text{change/verandering}$ }
- Equilibrium/Ewewig: $n(NO) = \text{initial/aanvanklik} + \text{change/verandering}$ ✓
- Divide $n(N_2)$, $n(O_2)$ & $n(NO)$ by 5 dm^3 . ✓
Deel $n(N_2)$, $n(O_2)$ & $n(NO)$ deur 5 dm^3 .
- Correct K_c expression (formulae in square brackets). ✓
Korrekte K_c -uitdrukking (formules in vierkanthakies).
- Substitution of concentrations into K_c expression. ✓
Vervanging van konsentrasies in K_c -uitdrukking.
- Substitution of K_c value. ✓
Vervanging van K_c -waarde .
- Final answer/Finale antwoord: $4,36 \times 10^{-3} \text{ mol} \cdot \text{dm}^{-3}$ ✓ ($0,004 \text{ mol} \cdot \text{dm}^{-3}$)

OPTION 1/OPSIE 1

	N_2	O_2	NO	
Initial quantity (mol) Aanvangshoeveelheid (mol)	2	2	0	
Change (mol) Verandering (mol)	x	x	2x	ratio ✓
Quantity at equilibrium (mol) Hoeveelheid by ewewig (mol)	2-x	2-x ✓	2x ✓	
Equilibrium concentration ($\text{mol} \cdot \text{dm}^{-3}$) Ewewigskonsentrasie ($\text{mol} \cdot \text{dm}^{-3}$)	$\frac{2-x}{5}$	$\frac{2-x}{5}$	$\frac{2x}{5}$	Divide by 5 ✓

$$K_c = \frac{[NO]^2}{[N_2][O_2]} \checkmark \therefore 1,2 \times 10^{-4} \checkmark = \frac{\left(\frac{2x}{5}\right)^2}{\left(\frac{2-x}{5}\right)\left(\frac{2-x}{5}\right)} \checkmark \frac{0,4^2}{0,2^2}$$

$$\therefore x = 0,0109 \text{ mol}$$

$$\therefore [NO] = \frac{2(0,0109)}{5} = 4,36 \times 10^{-3} \text{ mol} \cdot \text{dm}^{-3} \checkmark (0,004 \text{ mol} \cdot \text{dm}^{-3})$$

OPTION 2/OPSIE 2

	N ₂	O ₂	NO	
Initial quantity (mol) <i>Aanvangshoeveelheid (mol)</i>	2	2	0	
Change (mol) <i>Verandering (mol)</i>	$\frac{x}{2}$	$\frac{x}{2}$	x	ratio ✓
Quantity at equilibrium (mol) <i>Hoeveelheid by ewewig (mol)</i>	$2 - \frac{x}{2}$	$2 - \frac{x}{2}$ ✓	x ✓	
Equilibrium concentration (mol·dm ⁻³) <i>Ewewigskonsentrasie (mol·dm⁻³)</i>	$\frac{4-x}{10}$	$\frac{4-x}{10}$	$\frac{x}{5}$	Divide by 5 ✓

$$K_C = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]} \checkmark$$

$$\therefore 1,2 \times 10^{-4} \checkmark = \frac{\left(\frac{x}{5}\right)^2}{\left(\frac{4-x}{10}\right)\left(\frac{4-x}{10}\right)} \checkmark$$

$$\therefore x = 0,022 \text{ mol}$$

$$\therefore [\text{NO}] = \frac{0,022}{5} = 4,36 \times 10^{-3} \text{ mol}\cdot\text{dm}^{-3} \checkmark (0,004 \text{ mol}\cdot\text{dm}^{-3})$$

OPTION 3/OPSIE 3

	N ₂	O ₂	NO	
Initial quantity (mol) <i>Aanvangshoeveelheid (mol)</i>	2	2	0	
Change (mol) <i>Verandering (mol)</i>	$\frac{5x}{2}$	$\frac{5x}{2}$	5x	ratio ✓
Quantity at equilibrium (mol) <i>Hoeveelheid by ewewig (mol)</i>	$2 - \frac{5x}{2}$	$2 - \frac{5x}{2}$ ✓	5x ✓	
Equilibrium concentration / <i>Ewewigskonsentrasie</i> (mol·dm ⁻³)	$\frac{4-5x}{10}$	$\frac{4-5x}{10}$	x	Divide by 5 ✓

$$K_C = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]} \checkmark$$

$$\therefore 1,2 \times 10^{-4} \checkmark = \frac{(x)^2}{\left(\frac{4-5x}{10}\right)\left(\frac{4-5x}{10}\right)} \checkmark$$

$$\therefore x = 4,36 \times 10^{-3} \text{ mol}\cdot\text{dm}^{-3} \checkmark (0,004 \text{ mol}\cdot\text{dm}^{-3})$$

CALCULATIONS USING CONCENTRATIONS
BEREKENINGE WAT KONSENTRASIES GEBRUIK

Mark allocation/Puntetoekenning

- Divide $n(\text{N}_2)$ & $n(\text{O}_2)$ by 5 dm^3 . ✓
Deel $n(\text{N}_2)$ & $n(\text{O}_2)$ deur 5 dm^3 .
- **USING** ratio/**GEBRUIK** verhouding: $\text{N}_2 : \text{O}_2 : \text{NO} = 1 : 1 : 2$ ✓
- Equilibrium/Ewewig: $c(\text{N}_2) = \text{initial/aanvanklik} - \text{change/verandering}$ } ✓
Equilibrium/Ewewig: $c(\text{O}_2) = \text{initial/aanvanklik} - \text{change/verandering}$ }
Equilibrium/Ewewig: $c(\text{NO}) = \text{initial/aanvanklik} + \text{change/verandering}$ }
- Correct K_c expression (formulae in square brackets). ✓
Korrekte K_c -uitdrukking (formules in vierkanthakies).
- Substitution of concentrations into K_c expression. ✓
Vervanging van konsentrasies in K_c -uitdrukking.
- Substitution of K_c value ✓
Vervanging van K_c -waarde
- Calculate $c(\text{NO})$ i.e. 2 x answer of K_c calculation. ✓
Bereken $c(\text{NO})$ d.i. 2 x antwoord van K_c -berekening.
- Final answer/Finale antwoord: $4,36 \times 10^{-3} \text{ mol} \cdot \text{dm}^{-3}$ ✓ ($0,004 \text{ mol} \cdot \text{dm}^{-3}$)

OPTION 3/OPSIE 3

	N_2	O_2	NO
Initial concentration ($\text{mol} \cdot \text{dm}^{-3}$) <i>Aanvangskonsentrasie ($\text{mol} \cdot \text{dm}^{-3}$)</i>	0,4	0,4	0
Change ($\text{mol} \cdot \text{dm}^{-3}$) <i>Verandering ($\text{mol} \cdot \text{dm}^{-3}$)</i>	x	x	2x
Equilibrium concentration ($\text{mol} \cdot \text{dm}^{-3}$) <i>Ewewigskonsentrasie ($\text{mol} \cdot \text{dm}^{-3}$)</i>	0,4-x	0,4-x ✓	2x ✓

Divide by 5 ✓

ratio ✓

$$K_c = \frac{[\text{NO}]^2}{[\text{N}_2][\text{O}_2]^2} \checkmark$$

$$\therefore 1,2 \times 10^{-4} \checkmark = \frac{(2x)^2}{(0,4-x)(0,4-x)} \checkmark$$

$$\therefore x = 2,18 \times 10^{-3} \text{ mol} \cdot \text{dm}^{-3} \text{ (0,00218 mol} \cdot \text{dm}^{-3}\text{)}$$

$$\therefore [\text{NO}] = 2(2,18 \times 10^{-3}) = 4,36 \times 10^{-3} \text{ mol} \cdot \text{dm}^{-3} \checkmark \text{ (0,004 mol} \cdot \text{dm}^{-3}\text{)}$$

(8)

- 7.3
7.3.1 Remains the same / Bly dieselfde ✓ (1)
- 7.3.2 Remains the same / Bly dieselfde ✓ (1)

7.4 Endothermic / *Endotermies* ✓



- (An increase in K_C implies) an increase in concentration of products. ✓
(*'n Toename in K_C impliseer*) *'n toename in die konsentrasie van produkte.*

OR/OF

(An increase in K_C implies) that the forward reaction is favoured.

(*'n Toename in K_C impliseer*) *dat die voorwaartse reaksie bevoordeel is.*

OR/OF

(An increase in K_C implies) the equilibrium position shifts to the right.

(*'n Toename in K_C impliseer*) *dat die ewewigsposisie na regs geskuif het.*

- An increase in temperature favours an endothermic reaction. ✓

'n Toename in temperatuur bevoordeel die endotermiese reaksie.

(3)
[15]

QUESTION 8/VRAAG 8

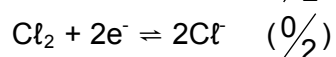
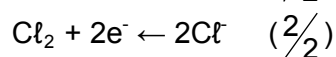
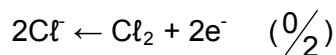
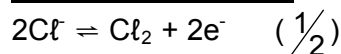
8.1

8.1.1 Au^{3+} / gold(III) ion ✓
Au³⁺ / goud(III)-ioon

(1)

8.1.2 $2Cl^- \rightarrow Cl_2 + 2e^-$ ✓✓

Notes/Aantekeninge



(2)

8.1.3 $Pt(s) | Cl^-(1 \text{ mol} \cdot \text{dm}^{-3}) | Cl_2(g) || Au^{3+}(1 \text{ mol} \cdot \text{dm}^{-3}) | Au(s)$

OR/OF

$Pt(s) | Cl^-(aq) | Cl_2(g) || Au^{3+}(aq) | Au(s)$

OR/OF

$Pt | Cl^- | Cl_2 || Au^{3+} | Au$

(3)

8.2

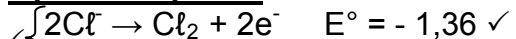
Option 1/Opsie 1

$$E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}} \quad \checkmark$$

$$0,14 \checkmark = E^\circ_{\text{cathode}} - (1,36) \checkmark$$

$$E^\circ_{\text{cathode}} = 1,50 \text{ V} \quad \checkmark$$

Option 2/Opsie 2



$$E^\circ = 0,14 \text{ V} \quad \checkmark$$

(4)

8.3 Smaller than / *Kleiner as* ✓



Decrease or drop in potential difference or voltage due to internal resistance or "lost volts". ✓

Val of afname in potensiaalverskil of spanning as gevolg van interne weerstand of "velore volts".

(2)
[12]

QUESTION 9/VRAAG 9

9.1 The chemical process in which electrical energy is converted to chemical energy. ✓✓

Die chemiese proses waarin elektriese energie omgeskakel word na chemiese energie.

OR/OF

The use of electrical energy to produce chemical change. ✓✓

Die gebruik van elektriese energie om chemiese verandering te weeg te bring.

(2)

9.2

9.2.1 $\text{Cr}^{3+} + 3\text{e}^{-} \rightarrow \text{Cr(s)}$ ✓✓ (2)

9.2.2 Cr / chromium / *chroom* ✓ (1)

9.2.3 Chromium(III) ions / *chroom(III)-ione* / Cr^{3+} ✓ (1)

9.3

Mark allocation/Puntetoekenning:

- $n = \frac{m}{M}$ or using ratio / *of gebruik van verhouding* ✓
- Ratio: 1 : 3 (1 mole Cr^{3+} gains 3 mole of electrons) ✓
Verhouding 1: 3 (1 mol Cr^{3+} neem 3 mol elektrone op)
- Using $M = 52$ in $m = nM$ or in ratio calculation. ✓
Gebruik $M = 52$ in $m = nM$ of verhouding berekening.
- Final answer/*Finale antwoord*: 0,52 g ✓

$n = \frac{m}{M}$ ✓

$\left(\frac{0,03}{3}\right) \checkmark = \frac{m}{52} \checkmark$ **OR/OF** $0,01 \checkmark = \frac{m}{52} \checkmark$

$\therefore m = 0,52 \text{ g}$ ✓

OR/OF

3 mol e^{-} 52 g ✓ Cr

0,03 mol e^{-} $\left(\frac{0,03}{3}\right) \checkmark (52) \checkmark = 0,52 \text{ g}$ ✓

(4)
[10]

QUESTION 10/VRAAG 10

10.1 A solution which conducts electricity through the movement of ions. ✓✓
'n Oplossing wat elektrisiteit gelei deur die beweging van ione. (2)

10.2 $\text{Pb(s)} + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{PbSO}_4(\text{s}) + 2\text{e}^-$ ✓✓ (2)

10.3 $\text{PbO}_2(\text{s}) + \text{Pb(s)} + 2\text{SO}_4^{2-}(\text{aq}) + 4\text{H}^+(\text{aq}) \rightarrow 2\text{PbSO}_4(\text{s}) + 2\text{H}_2\text{O}(\text{l})$ ✓ bal. ✓

OR/OF

$\text{PbO}_2(\text{s}) + \text{Pb(s)} + 2\text{H}_2\text{SO}_4(\text{aq}) \rightarrow 2\text{PbSO}_4(\text{s}) + 2\text{H}_2\text{O}(\text{l})$ ✓ bal. ✓ (3)

10.4

10.4.1	<p><u>OPTION 1/OPSIE 1</u></p> <p>$Q = I\Delta t$ $= (7\,500) \checkmark (3\,600) \checkmark$ $= 2,7 \times 10^7 \text{ C}$</p> <p>$W = VQ \checkmark$ $= (300) \checkmark (2,7 \times 10^7)$ $= 8,1 \times 10^9 \text{ J} \checkmark$</p>	<p><u>OPTION 2/OPSIE 2</u></p> <p>$W = VI\Delta t \checkmark$ $= (300) \checkmark (7\,500) \checkmark (3\,600) \checkmark$ $= 8,1 \times 10^9 \text{ J} \checkmark$</p>
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(5)

10.4.2 $E^\theta_{\text{cell}} = E^\theta_{\text{cathode}} - E^\theta_{\text{anode}} \checkmark$
 $= +1,69 \checkmark - (-0,36) \checkmark$
 $= +2,05 \text{ V}$

No. cells = $\frac{300}{2,05} \checkmark$
 $= 146,34 \text{ cells/selle}$

$\therefore 147 \text{ cells / selle} \checkmark$

(5)
[17]

QUESTION 11/VRAAG 11

- 11.1
11.1.1 Phosphorous / Fosfor / P ✓ (1)
11.1.2 Nitrogen / Stikstof / N ✓ (1)
11.1.3 Potassium / Kalium / K ✓ (1)
11.2
11.2.1 Haber (process)/(proses) ✓ (1)
11.2.2 $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ ✓ bal. ✓ (3)
-
- 11.3 The fertiliser contains two primary nutrients N/nitrogen and P/ phosphorous. ✓
whereas the ammonium nitrate contains only N/nitrogen. ✓
Die kunsmis bevat twee primêre nutriente N en P terwyl ammoniumnitraat slegs N bevat. (2)
- 11.4 **ANY ONE /ENIGE EEN**
- Fertilisers in water leads to eutrophication which can result in less drinking water / starvation due to dying of fish / less water recreation areas. ✓
Kunsmis in water lei tot eutrofisering / eutrofikasie wat minder drinkwater // hongersnood weens visvrektes /minder ontspanningsgebiede tot gevolg kan hê.
 - Fertilisers in water leads to excess of nitrates in water ✓
resulting in blue baby syndrome / cancer. ✓
Kunsmis in water lei tot oormaat nitrate in water wat lei tot bloubabasindroom / kanker. (2)

TOTAL SECTION B/TOTAAL AFDELING B: [11]
GRAND TOTAL/GROOTTOTAAL: 125
150