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-dimetiel*✓*heks-2-een* ✓

OR/*OF*
4,5-dimethyl✓-2-hexene ✓ / *4,5-dimetiel*✓*-2-hekseen* ✓ (2)

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

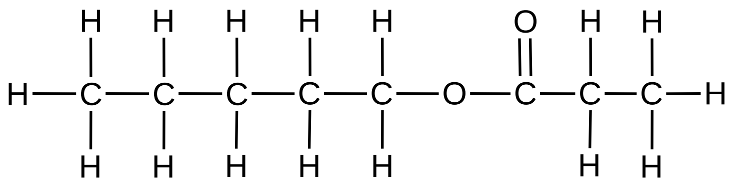
3.2.3 4-methyl✓pent-2-yne ✓ / *4-metielpent-2-yn*

OR/*OF*
4-methyl✓-2-pentyne ✓ / *4-metielpent-2-yn* (2)

3.3

3.3.1 Esters ✓ (1)

3.3.2



✓✓

(2)

3.3.3 Propanoic acid / *Propanoësuur* ✓ (1)

3.3.4 Sulphuric acid / *Swawelsuur* / H_2SO_4 ✓ (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 / homoloë 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 kettting. / 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 kettting. / 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]

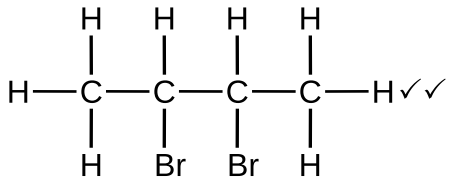
QUESTION 5/*VRAAG 5*

5.1 Alkenes / *Alkene* ✓ (1)

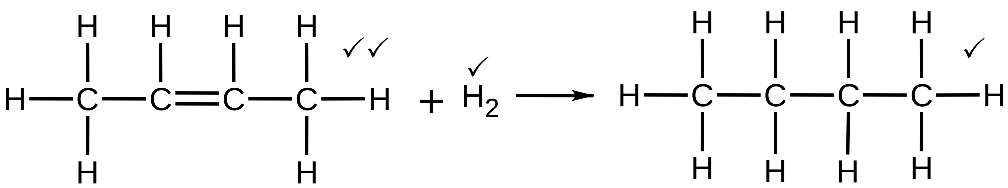
5.2
5.2.1 $C_4H_{10} + C\ell_2$ ✓ $\rightarrow C_4H_9C\ell + HC\ell$ ✓ Bal. ✓ (3)

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* $= \frac{\Delta[H_2O_2]}{\Delta t}$

$= \frac{0,0131 - 0,020 \checkmark}{400 - (0) \checkmark}$

$= -1,73 \times 10^{-5}\ mol{\cdot}dm^{-3}{\cdot}s^{-1}$ ✓

OR/*OF*

$1,73 \times 10^{-5}\ mol{\cdot}dm^{-3}{\cdot}s^{-1}$ (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/*Puntetoekenning:*

- $c = \frac{n}{V}$ or/*of* $n = \frac{m}{M}$ or/*of* $c = \frac{m}{MV}$ ✓
- Substitute / *Vervang* (0,0200 - 0,0106) and/*en* 50 x 10^{-3} ✓
- $n(O_2) = ½n(H_2O_2)$ ✓
- Using/*Gebruik* M = 32 in m = nM or/*of* cMV or/*of* a ratio calculation / *'n verhouding berekening* ✓
- Final answer/*Finale antwoord*: 7,52 x 10^{-3} g / 0,008 g / 0,01 g✓

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$c = \frac{n}{V}$ ✓ $(0,0200 - 0,0106) = \frac{n}{50 \times 10^{-3}}$ ✓ $\therefore n = 4,7 \times 10^{-4}$ mol $n(O_2) = ½n(H_2O_2) = ½(4,7 \times 10^{-4})$ ✓ $= 2,35 \times 10^{-4}$ mol $n(O_2) = \frac{m}{M}$ $2,35 \times 10^{-4} = \frac{m}{32}$ ✓ $\therefore m(O_2) = 7,52 \times 10^{-3}$ g = (0,008 g) = (0,01 g) ✓	$\Delta c(H_2O_2) = 0,0200 – 0,0106$ $= 0,0094$ $\Delta c(O_2) = ½\Delta c(H_2O_2)$ $= ½(0,0094)$ ✓ $= 0,0047$ ✓ $c = \frac{m}{MV}$ ✓ $\Delta m(O_2) = cMV$ $= (0,0047)(32)$ ✓ (50×10^{-3}) $= 7,52 \times 10^{-3}$ g = 0,008 g = 0,01g✓

(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/*Puntetoekenning:*

- **USING** ratio/***GEBRUIK*** *verhouding:* $N_2 : O_2 : NO = x : x : 2x$ ✓
- Equilibrium/*Ewewig:* $n(N_2)$ = initial/*aanvanklik* – change/*verandering*
  Equilibrium/*Ewewig*: $n(O_2)$ = initial/*aanvanklik* – change/*verandering* ✓
- Equilibrium/*Ewewig*: n(NO) = initial/*aanvanklik* + 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*: $4,36 \times 10^{-3}$ mol·dm^{-3} ✓ (0,004 mol·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 (mol·dm^{-3}) *Ewewigskonsentrasie (mol·dm^{-3})*	$\frac{2-x}{5}$	$\frac{2-x}{5}$	$\frac{2x}{5}$	Divide by 5 ✓

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

$\therefore x = 0,0109$ mol

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

OPTION 2/*OPSIE 2*

	N_2	O_2	NO	
Initial quantity (mol) *Aanvangshoeveelheid (mol)*	2	2	0	
Change (mol) *Verandering (mol)*	$\frac{x}{2}$	$\frac{x}{2}$	x	ratio ✓
Quantity at equilibrium (mol) *Hoeveelheid by ewewig (mol)*	$2-\frac{x}{2}$	$2-\frac{x}{2}$ ✓	x ✓	
Equilibrium concentration ($mol \cdot dm^{-3}$) *Ewewigskonsentrasie ($mol \cdot dm^{-3}$)*	$\frac{4-x}{10}$	$\frac{4-x}{10}$	$\frac{x}{5}$	Divide by 5 ✓

$K_C = \frac{[NO]^2}{[N_2][O_2]}$ ✓

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

$\therefore x = 0,022$ mol

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

OPTION 3/*OPSIE 3*

	N_2	O_2	NO	
Initial quantity (mol) *Aanvangshoeveelheid (mol)*	2	2	0	
Change (mol) *Verandering (mol)*	$\frac{5x}{2}$	$\frac{5x}{2}$	5x	ratio ✓
Quantity at equilibrium (mol) *Hoeveelheid by ewewig (mol)*	$2-\frac{5x}{2}$	$2-\frac{5x}{2}$ ✓	5x ✓	
Equilibrium concentration / Ewewigskonsentrasie ($mol \cdot dm^{-3}$)	$\frac{4-5x}{10}$	$\frac{4-5x}{10}$	x	Divide by 5 ✓

$K_C = \frac{[NO]^2}{[N_2][O_2]}$ ✓

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

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

CALCULATIONS USING CONCENTRATIONS
BEREKENINGE WAT KONSENTRASIES GEBRUIK

Mark allocation/*Puntetoekenning*

- Divide $n(N_2)$ & $n(O_2)$ by 5 dm^3. ✓
  Deel $n(N_2)$ & $n(O_2)$ deur 5 dm^3.
- **USING** ratio/***GEBRUIK*** *verhouding:* $N_2 : O_2 : NO = 1 : 1 : 2$ ✓
- Equilibrium/*Ewewig:* $c(N_2)$ = initial/*aanvanklik* – change/*verandering*
  Equilibrium/*Ewewig*: $c(O_2)$ = initial/*aanvanklik* – change/*verandering*
  Equilibrium/*Ewewig*: c(NO) = initial/*aanvanklik* + 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(NO) i.e. 2 x answer of K_c calculation. ✓
  Bereken c(NO) d.i. 2 x antwoord van K_c-berekening.
- Final answer/*Finale antwoord*: $4{,}36 \times 10^{-3}$ mol·dm^{-3} ✓ (0,004 mol·dm^{-3})

OPTION 3/*OPSIE 3*

	N_2	O_2	NO	
Initial concentration (mol·dm^{-3}) *Aanvangskonsentrasie (mol·dm^{-3})*	0,4	0,4	0	Divide by 5 ✓
Change (mol·dm^{-3}) *Verandering* (mol·dm^{-3})	x	x	2x	ratio ✓
Equilibrium concentration (mol·dm^{-3}) *Ewewigskonsentrasie (mol·dm^{-3})*	0,4-x	0,4-x ✓	2x✓	

$$K_C = \frac{[NO]^2}{[N_2][O_2]^2} \checkmark$$

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

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

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

(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* (3)
  (An increase in K_C implies) the equilibrium position shifts to the right. **[15]**
  ('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.

QUESTION 8/*VRAAG 8*

8.1

8.1.1 Au^{3+} / gold(III) ion ✓
Au^{3+} / goud(III)-ioon (1)

8.1.2 $2C\ell^- \rightarrow C\ell_2 + 2e^-$ ✓✓

Notes/*Aantekeninge*	
$2C\ell^- \rightleftharpoons C\ell_2 + 2e^-$	$(\frac{1}{2})$
$2C\ell^- \leftarrow C\ell_2 + 2e^-$	$(\frac{0}{2})$
$C\ell_2 + 2e^- \leftarrow 2C\ell^-$	$(\frac{2}{2})$
$C\ell_2 + 2e^- \rightleftharpoons 2C\ell^-$	$(\frac{0}{2})$

(2)

8.1.3 Pt(s) | $C\ell^-$ (1 mol·dm^{-3}) ✓ | $C\ell_2$(g) || ✓ Au^{3+}(1 mol·dm^{-3}) ✓ | Au(s)

OR/*OF*
Pt(s) | $C\ell^-$(aq) | $C\ell_2$(g) || Au^{3+} (aq) | Au(s)

OR/*OF*
Pt | $C\ell^-$ | $C\ell_2$ || Au^{3+} | Au (3)

8.2 **<u>Option 1/*Opsie 1*</u>**
$E^o_{cell} = E^o_{cathode} - E^o_{anode}$ ✓
0,14 ✓ = $E^o_{cathode}$ - (1, 36) ✓
$E^o_{cathode}$ = 1,50 V ✓

<u>Option 2/*Opsie 2*</u>
✓ $\begin{cases} 2C\ell^- \rightarrow C\ell_2 + 2e^- & E° = -1{,}36 \checkmark \\ Au^{3+} + 3e^- \rightarrow Au & \underline{E° = \ +1{,}50} \checkmark \end{cases}$
E° = 0,14 V ✓ (4)

8.3 Smaller than / *Kleiner as* ✓
Decrease or drop in potential difference or voltage <u>due to internal resistance or ”lost volts”</u>. ✓
Val of afname in potensiaalverskil of spanning <u>as gevolg van interne weerstand of “velore volts”.</u> (2)
[12]

QUESTION 9/*VRAAG 9*

9.1 The chemical process in which <u>electrical energy is converted to chemical energy.</u>✓✓
Die chemiese proses waarin <u>elektriese energie omgeskakel word na chemiese energie</u>.

OR/*OF*
The use of <u>electrical energy to produce chemical change</u>. ✓✓
Die gebruik van <u>elektriese energie om chemiese verandering te weeg te bring.</u> (2)

9.2
9.2.1 $Cr^{3+} + 3e^{-} \rightarrow Cr(s)$ ✓✓ (2)

9.2.2 Cr / chromium / *chroom* ✓ (1)

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

9.3

<u>Mark allocation/*Puntetoekenning:*</u>
• $n = \frac{m}{M}$ 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 ✓

$n = \frac{m}{M}$ ✓

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

$\therefore$ m = 0,52 g ✓

OR/*OF*
3 mol e^{-} .... 52 g ✓ Cr
0,03 mol e^{-}....... $\left(\frac{0{,}03}{3}\right)$ ✓ (52) ✓ = 0,52 g ✓
(4)
[10]

QUESTION 10/*VRAAG 10*

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

10.2 $Pb(s) + SO_4^{2-}(aq) \rightarrow PbSO_4(s) + 2e^-$ ✓✓ (2)

10.3 $PbO_2(s) + Pb(s) + 2SO_4^{2-}(aq) + 4H^+(aq)$ ✓ $\rightarrow 2PbSO_4(s) + 2H_2O(\ell)$ ✓ bal. ✓

OR/OF
$PbO_2(s) + Pb(s) + 2H_2SO_4(aq)$ ✓ $\rightarrow 2PbSO_4(s) + 2H_2O(\ell)$ ✓ bal. ✓ (3)

10.4
10.4.1

<u>OPTION 1/*OPSIE 1*</u>	**<u>OPTION 2/*OPSIE 2*</u>**
$Q = I\Delta t$ $= (7\,500)$ ✓ $(3\,600)$ ✓ $= 2,7\times10^7$ C $W = VQ$ ✓ $= (300)$ ✓ $(2,7\times10^7)$ $= 8,1 \times 10^9$ J ✓	$W = VI\Delta t$ ✓ $= (300)$✓ (7500) ✓ (3600) ✓ $= 8,1 \times 10^9$ J ✓

(5)

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

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

$\therefore$ 147 cells / *selle* ✓ (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)

[11]

TOTAL SECTION B/*TOTAAL AFDELING B:* 125

GRAND TOTAL/*GROOTTOTAAL*: 150