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REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

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

FEBRUARY/MARCH/FEBRUARIE/MAART 2013

MEMORANDUM

MARKS/PUNTE: 150

**This memorandum consists of 16 pages.
Hierdie memorandum bestaan uit 16 bladsye.**

SECTION A/AFDELING A

QUESTION 1/VRAAG 1

- 1.1 Alcohols/Alkanols ✓
Alkohole/Alkanole ✓ (1)
- 1.2 Cracking/Elimination ✓
Kraking/Eliminasie ✓ (1)
- 1.3 (Reaction) rate/Rate (of reaction)✓
(Reaksie-)tempo/Tempo (van reaksie)✓ (1)
- 1.4 Electrolysis/*Elektrolise* ✓ (1)
- 1.5 Haber (process)/*Haber(-proses)* ✓ (1)
- [5]**

QUESTION 2/VRAAG 2

- 2.1 D ✓✓ (2)
- 2.2 B ✓✓ (2)
- 2.3 A ✓✓ (2)
- 2.4 A ✓✓ (2)
- 2.5 C ✓✓ (2)
- 2.6 C ✓✓ (2)
- 2.7 D ✓✓ (2)
- 2.8 B ✓✓ (2)
- 2.9 D ✓✓ (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 E ✓ (1)
- 3.1.2 A ✓ (1)
- 3.1.3 A ✓ (1)
- 3.1.4 F ✓ (1)
- 3.1.5 A ✓ **OR/OF** D (1)
- 3.1.6 C ✓ (1)

3.2

3.2.1

Notes/Aantekeninge

Functional group: ✓

Whole structure correct: ✓

Funksionele groep: ✓

Hele struktuur korrek: ✓

Notes/Aantekeninge:

- Condensed or semistructural formula: $\frac{1}{2}$
Gekondenseerde of semistruktuurformule: $\frac{1}{2}$
- Molecular formula/Molekulêre formule: $\frac{0}{2}$

(2)

3.2.2

Notes/Aantekeninge:

- Condensed or semistructural formula:/Gekondenseerde of semistruktuurformule: $\frac{1}{2}$
- All bonds shown, one or more H atoms omitted: Max. $\frac{1}{2}$
Alle bindings aangetoon, een of meer H-atome uitgelaat: Maks. $\frac{1}{2}$
- Wrong number of bonds e.g. C atoms not forming 4 bonds: $\frac{0}{2}$
Verkeerde aantal bindings bv. C-atome vorm nie 4 bindings nie: $\frac{0}{2}$

(2)

3.3
3.3.1 Carbonyl (group)/Karboniel(groep) ✓ (1)

3.3.2 2-methyl✓propan-1-ol ✓
2-metiel✓propan-1-ol ✓

OR/OF

2-methyl✓-1-propanol ✓
2-metiel✓-1-propanol ✓

Notes/Aantekeninge:

IF/INDIEN:

2 methyl 1 propanol/2 metiel 1 propanol ✓ $\frac{1}{2}$

2 methylpropan 1 ol/2 metielpropan 1 ol ✓ $\frac{1}{2}$

(2)
[13]

QUESTION 4/VRAAG 4

4.1
4.1.1 Gas ✓ (1)

4.1.2 Lower than ✓
Isomers of A:
More branching/Molecules more compact./Smaller surface area (over which the intermolecular forces act.) ✓
Weaker/less intermolecular forces. ✓
Less energy needed to overcome intermolecular forces. ✓

Laer as ✓
Isomere van A:
Meer vertak/Molekule meer kompak./Kleiner oppervlakte (waaroor intermolekulêre kragte werk.) ✓
Swakker/minder intermolekulêre kragte. ✓
Minder energie benodig om intermolekulêre kragte te oorkom. ✓

OR/OF

Lower than ✓
A is less branched./has less compact molecules./has larger surface area (over which intermolecular forces act.) ✓
Stronger/more intermolecular forces. ✓
More energy needed to overcome intermolecular forces. ✓

Laer as ✓
A en B is minder vertak./het minder kompakte molekule./het groter oppervlakte (waaroor intermolekulêre kragte werk). ✓
Sterker/meer intermolekulêre kragte. ✓
Meer energie benodig om intermolekulêre kragte te oorkom. ✓

(4)

4.1.3 $2\text{C}_4\text{H}_{10} + 13\text{O}_2 \rightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$ ✓ bal. ✓

Notes/Aantekeninge

- | | | |
|-----------------------------------|------------|---------------|
| • Reactants ✓ | Products ✓ | Balancing ✓ |
| • Reaktanse ✓ | Produkke ✓ | Balansering ✓ |
| • Ignore/Ignoreer ⇌ | | |
| • Marking rule 3.9/Nasienreël 3.9 | | |

(3)

4.1.4 Compound B contains a carbonyl group/O atom (bonded to C atom) ✓
and is a polar (molecule)/dipole. ✓

*Verbinding B bevat 'n karbonielgroep/O-atoom (gebind aan 'n C-atoom) ✓
en is 'n polêre (molekuul)/dipool. ✓*

(2)

4.2

4.2.1 Compound D: Two sites for hydrogen bonding/forms dimers ✓
Compound C: One site for hydrogen bonding ✓

*Verbinding D: Twee punte vir waterstofbindings/vorm dimere ✓
Verbinding C: Een punt vir waterstofbinding ✓*

Both compounds have hydrogen bonding (between molecules). ✓
Compound D has two sites for/stronger/more hydrogen bonding./ ✓
*Beide verbindings het waterstofbindings (tussen molecule).
Verbinding D het twee punte vir/sterker/meer waterstofbinding.*

(2)

4.2.2 (Compound/Verbinding) C ✓
◀ Lowest boiling point/Laagste kookpunt ✓

(2)

[14]

- 5.4
5.4.1 Substitution ✓
Substitusie ✓ (1)
- 5.4.2 1-bromo✓butane ✓
1-bromo✓butaan ✓ (2)
- [13]**

QUESTION 6/VRAAG 6

- 6.1 Conical (flask)/Koniese (fles) ✓
OR/OF
Erlenmeyer (flask/fles) (1)
- 6.2 Collect gas produced./Measure volume of gas produced. ✓
Vang bereide gas op./Meet volume gas berei. ✓ (1)
- 6.3
6.3.1 Concentration/Konsentrasie ✓ (1)
- 6.3.2 **ANY ONE/ENIGE EEN:**
Temperature ✓
Surface area/State of division
Temperatuur ✓
Reaksieoppervlak/Toestand van verdeeldheid (1)
- 6.4 P ✓
Higher (acid) concentration in experiment 2. ✓
Steeper slope/Greater gradient ✓
Hoër (suur)konsentrasie in eksperiment 2. ✓
Steiler helling/Groter gradiënt. ✓
OR/OF
Higher (acid) concentration in experiment 2. ✓
Same volume of gas produced/collected in a shorter time/faster. ✓
Hoër (suur)konsentrasie in eksperiment 2. ✓
Dieselfde volume gas berei/opgevang in 'n korter tyd/vinniger. ✓ (3)
- 6.5 Concentration of acid decreases as reaction proceeds. ✓
Konsentrasie van suur verminder soos wat die reaksie verloop. ✓
OR/OF
Surface area of Zn decreases.
Reaksieoppervlak van Zn verminder. (1)

6.6

$$\begin{aligned}
 n(\text{H}_2) &= \frac{V}{V_m} \\
 &= \frac{0,24}{24,04} \checkmark \\
 &= 0,01 \text{ mol} \checkmark \\
 n(\text{Zn}) &= \frac{m}{M} \\
 \therefore 0,01 \checkmark &= \frac{m}{65} \checkmark \\
 \therefore m &= 0,65 \text{ g} \checkmark
 \end{aligned}$$

OR/OF

$$1 \text{ mole/mol H}_2 \text{ gas} = 24,04 \text{ dm}^3 \checkmark$$

$$0,01 \text{ mol/mol} \checkmark \text{ H}_2 \text{ gas} = 0,24 \text{ dm}^3 \checkmark$$

$$65 \text{ g Zn} = 1 \text{ mole/mol} \checkmark$$



$$0,65 \text{ g} \checkmark = 0,01 \text{ mole/mol} \checkmark$$

Mark Allocation/Puntetoekenning

- Substitute volume.
Vervang volume.
- Substitute molar volume.
Vervang molêre volume.
- $n(\text{H}_2) = 0,01 \text{ mol}$
- $n(\text{Zn}) = n(\text{H}_2)$
- Substitute/Vervang $65 \text{ g} \cdot \text{mol}^{-1}$.
- Answer/Antwoord

(6)
[14]

QUESTION 7/VRAAG 7

7.1  Exothermic ✓
 ΔH is negative./less than zero. ✓



 Eksotermies ✓
 ΔH is negatief./kleiner as nul. ✓

OR/OF

 Exothermic/Eksotermies ✓
 Energy is released./Energie word vrygestel. ✓



(2)



7.2

7.2.1  Greater than/Greater at t_1 than at t_2 . ✓
 Larger/Steeper gradients/slopes. ✓

 Groter as/Groter by t_1 as t_2 .
 Groter/steiler gradiënte/hellings.

OR/OF

 Smaller at t_2 than at t_1 . ✓
 Smaller/less steep gradients/slopes. ✓

 Kleiner by t_2 as by t_1 . ✓
 Kleiner/minder steil gradiënte/hellings. ✓

(2)

7.2.2 Equal to/Gelyk aan ✓

(1)

7.2.3 **CALCULATIONS USING NUMBER OF MOLES**
BEREKENINGE WAT AANTAL MOL GEBRUIK

Mark allocation/Puntetoekenning

- Initial amount of reactants: $n(\text{HCl}) = 1 \text{ mol}$ & $n(\text{O}_2) = 0,3 \text{ mol}$ ✓
 Aanvanklike hoeveelheid reaktanse: $n(\text{HCl}) = 1 \text{ mol}$ & $n(\text{O}_2) = 0,3 \text{ mol}$
- Equilibrium/Ewewig: $n(\text{O}_2) = 0,1 \text{ mol}$ ✓
- USING** ratio/**GEBRUIK** verhouding: $4 : 1 : 2 : 2$ ✓
- Equilibrium: $n(\text{HCl}) = 0,2 \text{ mol}$ (initial – change) ✓
 Ewewig: $n(\text{HCl}) = 0,2 \text{ mol}$ (aanvanklik – verandering)
- Equilibrium: $n(\text{H}_2\text{O}) = n(\text{Cl}_2) = 0,4 \text{ mol}$ (initial + change) ✓
 Ewewig: $n(\text{H}_2\text{O}) = n(\text{Cl}_2) = 0,4 \text{ mol}$ (aanvanklik – verandering)
- Divide by volume/Gedeel deur volume (5 dm^3) ✓
- Correct K_c expression (formulae in square brackets) ✓
 Korrekte K_c -uitdrukking (formules tussen vierkanthakies) ✓
- Substitution of concentrations/Vervanging van konsentrasies ✓
- Final answer/Finale antwoord: 800 ✓

Option 1/Opsie 1:

From graph/Uit grafiek:

Initially/Aanvanklik $n(\text{HCl}) = 1 \text{ mol}$ & $n(\text{O}_2) = 0,3 \text{ mol}$ ✓At equilibrium/By ewewig $n(\text{O}_2) = 0,1 \text{ mol}$ ✓

Ratio/verhouding: ✓

 $n(\text{HCl})$ reacted/gereageer = $4n(\text{O}_2)$ reacted/gereageer $n(\text{H}_2\text{O})$ formed/gevorm = $n(\text{Cl}_2)$ formed/gevorm = $2n(\text{O}_2)$ reacted/gereageer
= $2(0,2) = 0,4 \text{ mol}$

At equilibrium/By ewewig:

 $n(\text{HCl}) = 0,2 \text{ mol}$ (initial/aanvanklik – change/verandering) ✓ $n(\text{H}_2\text{O}) = n(\text{Cl}_2) = 0,4 \text{ mol}$ (initial/aanvanklik + change/verandering) ✓

Equilibrium concentration/Ewewigskonsentrasies:

$$c(\text{HCl}) = \frac{n}{V} = \frac{0,2}{5} = 0,04 \text{ mol} \cdot \text{dm}^{-3}$$

$$c(\text{O}_2) = \frac{n}{V} = \frac{0,1}{5} = 0,02 \text{ mol} \cdot \text{dm}^{-3}$$

$$c(\text{H}_2\text{O}) = \frac{n}{V} = \frac{0,4}{5} = 0,08 \text{ mol} \cdot \text{dm}^{-3}$$

$$c(\text{Cl}_2) = \frac{n}{V} = \frac{0,4}{5} = 0,08 \text{ mol} \cdot \text{dm}^{-3}$$

Divide by 5 ✓
Deel deur 5

$$K_c = \frac{[\text{H}_2\text{O}]^2 [\text{Cl}_2]^2}{[\text{HCl}]^4 [\text{O}_2]} \quad \therefore \quad \frac{(0,08)^2 (0,08)^2}{(0,04)^4 (0,02)} = 800 \quad \checkmark$$

No K_c expression, correct substitution/Geen K_c -uitdrukking, korrekte substitusie:Max./Maks. $\frac{8}{9}$ Wrong K_c expression/Verkeerde K_c -uitdrukking:Max./Maks. $\frac{6}{9}$

Option 2/Opsie 2

	HCl	O ₂	H ₂ O	Cl ₂	
Initial quantity (mol) <i>Aanvangshoeveelheid (mol)</i>	1	0,3 ✓	0	0	
Change (mol) <i>Verandering (mol)</i>	-0,8	-0,2	+ 0,4	+ 0,4	ratio ✓ verhouding
Quantity at equilibrium (mol)/ <i>Hoeveelheid by ewewig(mol)</i>	0,2 ✓	0,1 ✓	0,4	0,4 ✓	
Equilibrium concentration (mol·dm ⁻³) <i>Ewewigskonsentrasie (mol·dm⁻³)</i>	$\frac{0,2}{5}$ (0,04)	$\frac{0,1}{5}$ (0,02)	$\frac{0,4}{5}$ (0,08)	$\frac{0,4}{5}$ (0,08)	Divide by 5 ✓ Deel deur 5

$$K_c = \frac{[\text{H}_2\text{O}]^2 [\text{Cl}_2]^2}{[\text{HCl}]^4 [\text{O}_2]} \checkmark \therefore \frac{(0,08)^2 (0,08)^2}{(0,04)^4 (0,02)} \checkmark = 800 \checkmark$$

No K_c expression, correct substitution/Geen K_c-uitdrukking, korrekte substitusie:

Max./Maks. $\frac{8}{9}$

Wrong K_c expression/Verkeerde K_c-uitdrukking:

Max./Maks. $\frac{6}{9}$

CALCULATIONS USING CONCENTRATIONS
BEREKENINGE WAT KONSENTRASIES GEBRUIK

Mark allocation/Punttoekenning

- Initial concentration of reactants/Aanvanklike konsentrasie van reaktanse:
c(HCl) = 0,2 ✓ & c(O₂) = 0,06 mol·dm⁻³ ✓
- Equilibrium/Ewewig: c(O₂) = 0,02 mol·dm⁻³ ✓
- USING ratio/GEBRUIK verhouding: 4 : 1 : 2 : 2 ✓
- Equilibrium: c(HCl) = 0,04 mol (initial – change) ✓
Ewewig: c(HCl) = 0,04 mol (aanvanklik – verandering)
- Equilibrium/Ewewig: c(H₂O) = c(Cl₂) = 0,08 mol (initial + change) ✓
Ewewig: c(H₂O) = c(Cl₂) = 0,08 mol (aanvanklik + verandering)
- Correct K_c expression (formulae in square brackets). ✓
Korrekte K_c -uitdrukking (formules tussen vierkanthakies).
- Substitution of concentrations/Vervanging van konsentrasies. ✓
- Final answer/Finale antwoord: 800 ✓

Option 3/Opsie 3

	HCl	O ₂	H ₂ O	Cl ₂
Initial concentration (mol·dm ⁻³) <i>Aanvangshoeveelheid (mol·dm⁻³)</i>	$\frac{1}{5} = 0,2$	$\frac{3}{5} = 0,06$	0	0
Change (mol·dm ⁻³) <i>Verandering (mol·dm⁻³)</i>	-0,16	-0,04	+0,08	+0,08
Equilibrium concentration (mol·dm ⁻³) <i>Ewewigskonsentrasie (mol·dm⁻³)</i>	0,04 ✓	0,02 ✓	0,08	0,08

Divide by 5 ✓

ratio ✓

$$K_C = \frac{[\text{H}_2\text{O}]^2 [\text{Cl}_2]^2}{[\text{HCl}]^4 [\text{O}_2]} \therefore \frac{(0,08)^2 (0,08)^2}{(0,04)^4 (0,02)} = 800$$

No K_C expression, correct substitution/Geen K_C uitdrukking, korrekte substitusie:
Max./Maks. $\frac{8}{9}$

Wrong K_C expression/Verkeerde K_C-uitdrukking: Max./Maks. $\frac{6}{9}$

(9)

- 7.3 Decreases ✓
Higher temperature favours the endothermic reaction. ✓
The reverse reaction is favoured. ✓
Less products/more reactants. ✓

- Verminder ✓
Hoër temperatuur bevoordeel die endotermiese reaksie. ✓
Die terugwaartse reaksie word bevoordeel. ✓
Minder produkte/meer reaktanse. ✓

(4)

- 7.4
7.4.1 Decreases/Verminder ✓ (1)
7.4.2 Remains the same/Bly dieselfde ✓ (1)
7.4.3 Decreases/Verminder ✓ (1)

[21]

QUESTION 8/VRAAG 8

8.1 Pressure/Druk: 101,3 kPa ($1,013 \times 10^5$ Pa) ✓
Temperature/Temperatuur: 25 °C (298 K) ✓ (2)

8.2 Salt bridge/Soutbrug ✓ (1)

8.3 Anode ✓
 It/ Mg is a stronger reducing agent ✓ than H_2 ✓
 and (Mg) will be oxidised. ✓
Dit/Mg is 'n sterker reduseermiddel ✓ as H_2 ✓
en (Mg) sal geoksideer word. ✓

OR/OF
 Anode ✓
 H_2 is a weaker reducing agent ✓ than Mg/ it. ✓
 and Mg will be oxidised. ✓
 H_2 is 'n swakker reduseermiddel ✓ as Mg/dit ✓
en Mg sal geoksideer word. ✓ (4)

8.4 $Mg(s) | Mg^{2+}(1 \text{ mol} \cdot dm^{-3}) || H^+(1 \text{ mol} \cdot dm^{-3}) | H_2(g) | Pt(s)$

OR/OF

$Mg(s) | Mg^{2+}(aq) || H^+(aq) | H_2(g) | Pt(s)$

OR/OF

$Mg | Mg^{2+} || H^+ | H_2 | Pt$

Accept/Aanvaar:

$Mg | Mg^{2+} || H^+ | H_2, Pt$ (3)

8.5 **Option 1/Opsie 1**
 $E^\theta_{\text{cell}} = E^\theta_{\text{cathode}} - E^\theta_{\text{anode}}$ ✓
 $2,36 \text{ V} = 0,00 - (E^\theta_{\text{anode}})$ ✓
 $E^\theta_{\text{anode}} = -2,36 \text{ V}$ ✓

Option 2/Opsie 2

✓ $\begin{cases} Mg \rightarrow Mg^{2+} + 2e^- & E^\circ = +2,36 \\ 2H^+ + 2e^- \rightarrow H_2 & E^\circ = 0,00 \end{cases}$ ✓
 $E^\circ = 2,36 \text{ V}$ ✓
 $Mg \text{ (red. pot.)} = -2,36 \text{ V}$ ✓

Notes/Aantekeninge

Accept any other correct formula from the data sheet.

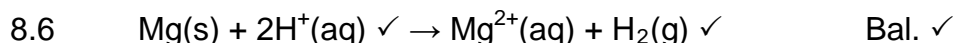
Aanvaar enige ander korrekte formule vanaf gegewensblad.

Any other formula using unconventional abbreviations, e.g. $E^\circ_{\text{cell}} = E^\circ_{\text{OA}} - E^\circ_{\text{RA}}$ followed by correct substitutions: $\frac{3}{4}$

Enige ander formule wat onkonvensionele afkortings gebruik bv.

$E^\circ_{\text{sel}} = E^\circ_{\text{OM}} - E^\circ_{\text{RM}}$

(4)



Notes/Aantekeninge

- Reactants \checkmark Products \checkmark Balancing \checkmark
Reaktanse \checkmark Produkte \checkmark Balansering \checkmark
- Ignore if phases are omitted./Ignoreer indien fases uitgelaat word.
- Ignore/Ignoreer \Rightarrow
- Marking rule 3.9/Nasienreël 3.9
- Marking rule 3.4: One mark is forfeited when the charge of an ion is omitted per equation (not for the charge on an electron).
Nasienreël 3.4: Een punt word verbeur per vergelyking indien die lading op 'n ioon uitgelaat word (nie vir die lading op 'n elektron nie.)

(3)
[17]

QUESTION 9/VRAAG 9

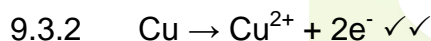
9.1 Electrolytic/Elektrolities \checkmark (1)

9.2
9.2.1 A \checkmark (1)

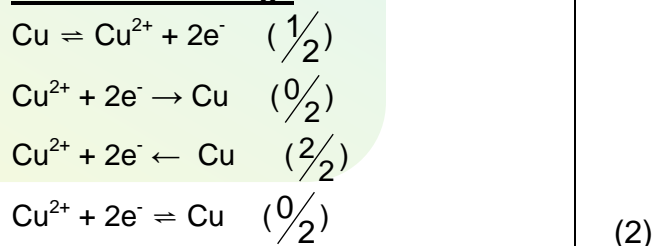
9.2.2 B \checkmark (1)

9.3
9.3.1 \ominus Remains the same \checkmark
The rate of oxidation of copper at the anode is equal \checkmark
to the rate of reduction of copper(II) ions at the cathode. \checkmark

\ominus Bly dieselfde \checkmark
Die tempo van oksidasie van koper by die anode is gelyk aan \checkmark
Die tempo van reduksie van koper(II)-ione by die katode. \checkmark (3)



Notes/Aantekeninge



9.4
9.4.1 It contains precious metals/valuable/expensive metals. \checkmark
Dit bevat edelmetale/waardevole/duur metale. \checkmark (1)

9.4.2 Consumes large amount of electricity/energy. \checkmark
Depletes coal resources. **OR** Contributes to global warming. **OR** Habitats destroyed in mining of coal. **OR** Contributes to acid rain. \checkmark

Verbruik groot hoeveelheid elektrisiteit/energie. \checkmark
Put steenkoolbronne uit. **OF** Dra by tot aardverwarming. **OF** Habitatte word vernietig. **OF** Dra by tot suurreën. \checkmark

(2)
[11]

QUESTION 10/VRAAG 10

10.1 Secondary (cells)/Sekondêre (selle) ✓ (1)

10.2 $\text{Zn(s)} + \text{NiO}_2\text{(s)} + 2\text{H}_2\text{O(l)} \rightarrow \text{Zn}^{2+}\text{(aq)} + \text{Ni(OH)}_2\text{(s)} + 2\text{OH}^-\text{(aq)}$ ✓ bal ✓

Notes/Aantekeninge:

- Reactants ✓ Products ✓ Balancing ✓
Reaktanse ✓ Produkte ✓ Balansering ✓
- Ignore if phases are omitted / Ignoreer indien fases uitgelaat word
- Ignore/Ignoreer ⇌
- Marking rule/Nasienreël 3.9

(3)

10.3

10.3.1 The ability (of a cell) to store/deliver charge. ✓✓
Die vermoë (van 'n sel) om lading te stoor/lewer.

(2)

10.3.2

OPTION 1/OPSIE 1

$$\begin{aligned} W &= Vq \checkmark \\ &= (1,65)(1\,500 \times 10^{-3} \times 3\,600) \checkmark \\ &= 8\,910 \text{ J } \checkmark \end{aligned}$$

OPTION 2/OPSIE 2

$$\begin{aligned} q &= I\Delta t \\ &= (1\,500 \times 10^{-3})(3\,600) \checkmark \\ \therefore q &= 5\,400 \text{ C} \end{aligned}$$

$$\begin{aligned} W &= Vq \checkmark \\ W &= (1,65)(5\,400) \checkmark \\ &= 8\,910 \text{ J } \checkmark \end{aligned}$$

(4)

[10]

QUESTION 11/VRAAG 11

11.1
11.1.1 Nitrogen/*Stikstof*/N₂ ✓ (1)

11.1.2 Hydrogen/*Waterstof*/H₂ ✓ (1)

11.1.3 Ammonium nitrate/*Ammoniumnitraat*/NH₄NO₃ ✓ (1)

11.2
11.2.1 Contact process/*Kontakproses* ✓ (1)

11.2.2 2NH₃ + H₂SO₄ ✓ → (NH₄)₂SO₄ ✓ Bal. ✓

Notes/Aantekeninge:

- Reactants ✓ Products ✓ Balancing ✓
Reaktanse ✓ Produkte ✓ Balansering ✓
- Ignore/*Ignoreer* =
- Marking rule/*Nasienreël* 3.9

(3)

11.3
11.3.1 Catalytic oxidation of ammonia ✓
Katilitiese oksidasie van ammoniak ✓ (1)

11.3.2 4NH₃ + 5O₂ ✓ → 4NO + 6H₂O ✓ Balancing/*Balansering* ✓

Notes/Aantekeninge:

- Reactants ✓ Products ✓ Balancing ✓
Reaktanse ✓ Produkte ✓ Balansering ✓
- Ignore/*Ignoreer* =
- Marking rule/*Nasienreël* 3.9

(3)

11.3.3 NO₂/Nitrogen dioxide ✓
NO₂/*Stikstofdioksied* ✓

Notes/Aantekeninge

- Accept: Nitrogen(IV) oxide ✓
Aanvaar. *Stikstof(IV)oksied*

(1)

[12]

TOTAL SECTION B/TOTAAL AFDELING B: 125
GRAND TOTAL/GROOTTOTAAL: 150