



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)**

FEBRUARY/MARCH/FEBRUARIE/MAART 2016

MEMORANDUM

MARKS/PUNTE: 150

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

QUESTION 1/VRAAG 1

- 1.1 B ✓✓ (2)
 1.2 B ✓✓ (2)
 1.3 A ✓✓ (2)
 1.4 B ✓✓ (2)
 1.5 D ✓✓ (2)
 1.6 B ✓✓ (2)
 1.7 C ✓✓ (2)
 1.8 D ✓✓ (2)
 1.9 A ✓✓ (2)
 1.10 C ✓✓ (2)
[20]

QUESTION 2/VRAAG 2

- 2.1
 2.1.1 Ketones/ketone ✓ (1)
 2.1.2 3,5-dichloro ✓ -4-methyl ✓ octane ✓
3,5-dichloor-4-metieloktaan OF 3,5-dichloro-4-metieloktaan

Marking criteria/Nasienriglyne

- 3,5-dichloro **OR/OF** 3,5 dichloro ✓
- -4-methyl/-4-metiel **OR/OF** 4 methyl/4 metiel ✓
- octane/oktaan ✓

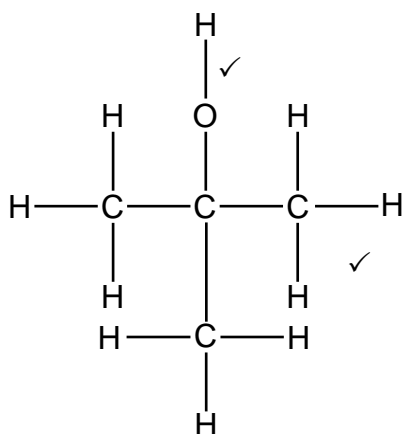
IF/INDIEN:

Any error, e.g. hyphens omitted and/or incorrect sequence. Max $\frac{2}{3}$

Enige fout, bv. uitlaat van koppeltekens en/of verkeerde volgorde. Maks $\frac{2}{3}$

(3)

2.1.3



Notes/Aantekeninge:

- Functional group (-OH) on **second C atom.** ✓
 Funksionele groep (-OH) op **tweede C-atoom.**
- Whole structure correct ✓
 Hele struktuur korrek

(2)

2.2

2.2.1 Acts as catalyst./Increases the rate of reaction./Act as dehydrating agent. ✓
Tree as katalisator op./Verhoog die tempo van die reaksie./Tree as dehidreermiddel op. (1)

2.2.2 Water/H₂O ✓ (1)

2.2.3 mol C : mol H : mol O
 $\frac{40}{12} \checkmark : \frac{6,67}{1} \checkmark : \frac{53,33}{16} \checkmark$

3,33 : 6,67 : 3,33
1 : 2 : 1 ✓

Empirical formula/*Empiriese formule*:
CH₂O ✓

Marking criteria/Nasiemriglyne:

- % divide by M(C). ✓
% gedeel deur M(C).
- % divide by M(H). ✓
% gedeel deur M(H).
- % divide by M(O). ✓
% gedeel deur M(O).
- Simplest mole ratio. ✓
Eenvoudigste molverhouding.
- CH₂O ✓

(5)

2.2.4 M(CH₂O) = 30 g·mol⁻¹ ✓
Formula-units/*Formule-eenhede*:

$$\frac{60}{30} = 2 \checkmark$$

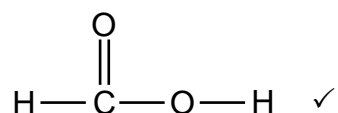
Molecular formula/*Molekulêre formule*: C₂H₄O₂ ✓

Marking criteria/Nasiemriglyne:

- 30 (g·mol⁻¹) ✓
- Formula-units = 2 ✓
Formule-eenhede = 2
- C₂H₄O₂ ✓

(3)

2.2.5



Notes/Aantekeninge:

- Accept –OH as condensed.
Aanvaar –OH as gekondenseerd.

(1)

2.2.6 Methyl ✓ methanoate ✓
Metielmetanoaat

(2)

[19]

QUESTION 3/VRAAG 3

3.1 Temperature ✓ at which the vapour pressure equals atmospheric pressure. ✓
Temperatuur waar die dampdruk gelyk is aan atmosferiese druk. (2)

3.2 The stronger the intermolecular forces, the higher the boiling point./The boiling point is proportional to the strength of intermolecular forces. ✓
Hoe sterker die intermolekulêre kragte, hoe hoër die kookpunt./Die kookpunt is eweredig aan die sterkte van intermolekulêre kragte.

Notes/Aantekeninge:

IF/INDIEN

Boiling point is directly proportional to strength of intermolecular forces:

Kookpunt direk eweredig aan sterkte van intermolekulêre kragte: $\frac{0}{1}$

(1)

3.3

3.3.1 • In **A**/propane/alkanes: London forces/dispersion forces/induced dipole forces ✓
*In **A**/propaan/alkane: Londonkragte/dispersiekragte/geïnduseerde dipoolkragte*

• In **B**/propan-2-one/ketones: dipole-dipole forces ✓ in addition to London forces/dispersion forces/induced dipole forces
*In **B**/propan-2-oon/ketone: dipool-dipoolkragte tesame met Londonkragte/dispersiekragte/geïnduseerde dipoolkragte*

• Intermolecular forces in A are weaker ✓ than in **B**./Intermolecular forces in **B** are stronger ✓ than in **A**./London forces are weaker than dipole-dipole forces.
*Intermolekulêre kragte in A swakker as in **B**./Intermolekulêre kragte in **B** sterker* as in **A**./*Londonkragte is swakker as dipool-dipoolkragte.* (3)

3.3.2 • Both **C** and **D**: hydrogen bonding ✓
*Beide **C** en **D**: waterstofbinding*

• **D** has two/more sites for hydrogen bonding./**D** forms dimers./**D** is more polar./**C** has one/less sites for hydrogen bonding. ✓
***D** het twee/meer plekke vir waterstofbinding./**D** vorm dimere./**D** is meer polêr./**C** het een/minder plekke vir waterstofbinding.*

• **D** has stronger intermolecular forces than **C**./**C** has weaker intermolecular forces than **D**. ✓
***D** het sterker intermolekulêre kragte as **C**./**C** het swakker intermolekulêre kragte as **D**.* (3)

3.4 Liquid/Vloeistof ✓ (1)

[10]

QUESTION 4/VRAAG 4

4.1

4.1.1 Addition/Addisie ✓ (1)

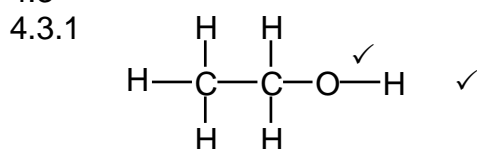
4.1.2 Polyethene/polythene/polyethelene ✓
Polieteen/politeen/polietileen (1)

4.2.

4.2.1 Chloro✓ethane✓
Chloroetaan/chlooretaan (2)

4.2.2 Hydrohalogenation/hydrochlorination ✓
Hidrohalogenering/hidrochloronering (1)

4.3



Notes/Aantekeninge:

- Functional group. ✓
Functional group.
- Whole structure correct ✓
Hele struktuur korrek

(2)

4.3.2 HCl/hydrogen chloride/waterstofchloried ✓ (1)

4.4

4.4.1 Saturated/Versadig ✓



There are no double/multiple bonds between C atoms./Carbon atoms are bonded to the maximum number of H atoms. ✓

Daar is geen dubbel- of meervoudige bindings tussen C-atome./Koolstof-atome gebind aan maksimum aantal H-atome. (2)

4.4.2 H₂/hydrogen (gas)/waterstof(gas) ✓ (1)

4.4.3 2C₂H₆ + 7O₂ → 4CO₂ + 6H₂O

Notes/Aantekeninge

- Reactants ✓ Products ✓ Balancing ✓
Reaktanse ✓ Produkte ✓ Balansering ✓
- Ignore/Ignoreer ⇌ and phases/en fases
- Marking rule 6.3.10./Nasienreël 6.3.10.

(3)

[14]

QUESTION 5/VRAAG 5

5.1 **ONLY ANY TWO OF/SLEGS ENIGE TWEE VAN:**

- Increase temperature./Verhoog die temperatuur. ✓
- Increase concentration of acid./Verhoog die konsentrasie van die suur. ✓
- Add a catalyst./ Voeg 'n katalisator by.

(2)

5.2 **ONLY ANY ONE OF/SLEGS ENIGE EEN VAN:**

- Change in concentration of products/reactants ✓ per (unit) time. ✓
Verandering in konsentrasie van produkte/reaktanses per (eenheids)tyd.
- Rate of change in concentration. ✓✓
Tempo van verandering in konsentrasie.
- Change in amount/number of moles/volume/mass of products or reactants per (unit) time.
Verandering in hoeveelheid/getal mol/volume/massa van produkte of reaktanses per (eenheids)tyd.
- Amount/number of moles/volume/mass of products formed or reactants used per (unit) time.
Hoeveelheid/getal mol/volume/massa van produkte gevorm of reaktanses gebruik per (eenheids)tyd.

(2)

5.3

5.3.1

$$\begin{aligned} \text{average rate / gemiddelde tempo} &= - \frac{\Delta c}{\Delta t} \\ &= - \frac{(1,45 - 1,90)}{(15 - 0)} \checkmark \\ &= 0,03 \text{ (mol} \cdot \text{dm}^{-3}) \cdot \text{min}^{-1} \checkmark \end{aligned}$$

Notes/Aantekeninge

Accept / Aanvaar:

- If unit omitted/Indien eenheid weggelaat is.

- Rate/Tempo = $\frac{\Delta c}{\Delta t}$

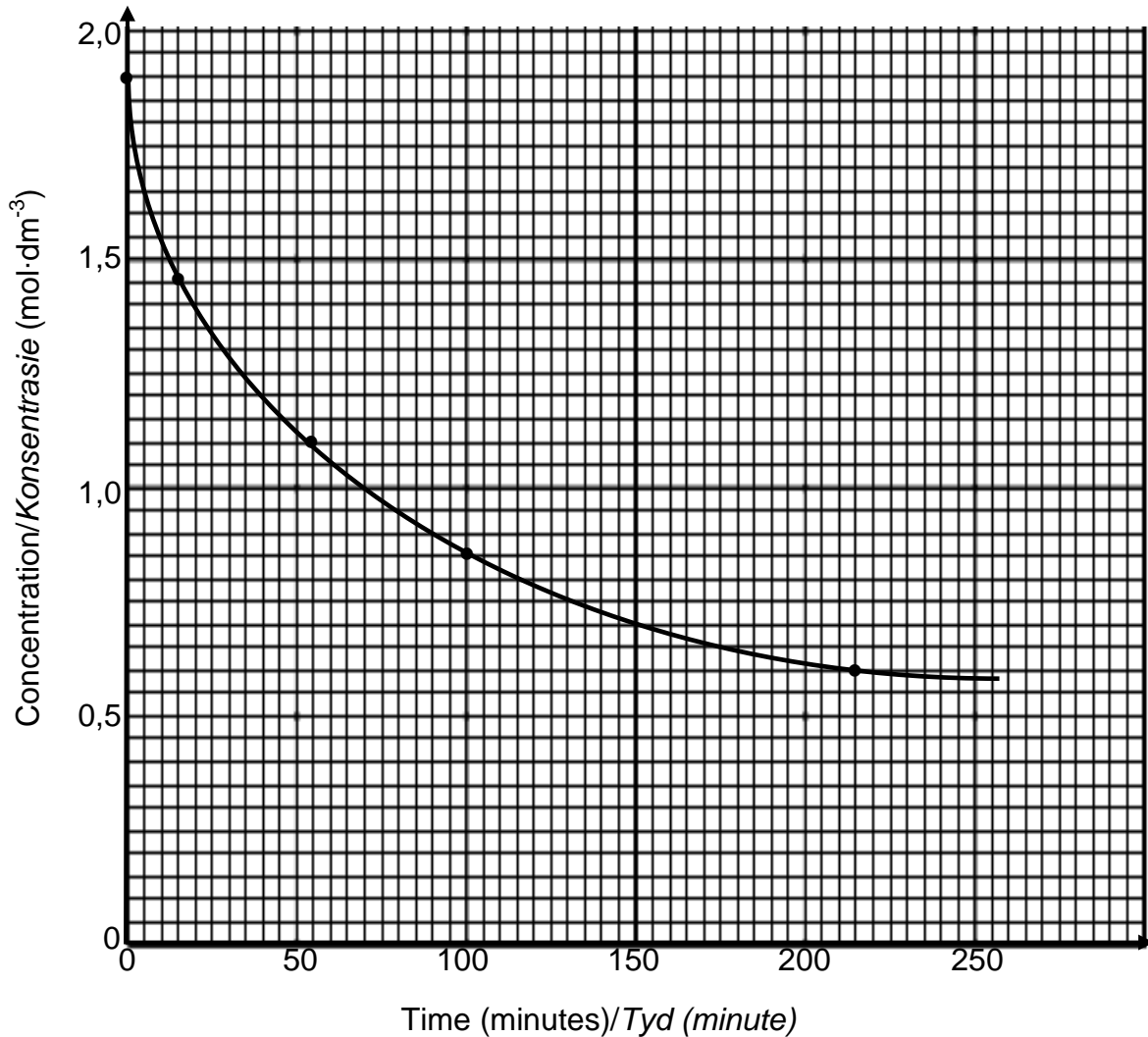
$$= \frac{1,45 - 1,90}{15 - 0}$$

$$= -0,03 \text{ (mol} \cdot \text{dm}^{-3}) \cdot \text{min}^{-1}$$

(3)

5.3.2

Graph of concentration versus time
Grafiek van konsentrasie teenoor tyd



Marking criteria/Nasienriglyne	
Four points correctly plotted./Vier punte korrek gestip.	✓✓
Curve drawn as shown./Kurwe getrek soos getoon.	✓

(3)

5.3.3

POSITIVE MARKING FROM QUESTION 5.3.2.

POSITIEWE NASIEN VANAF VRAAG 5.3.2.

1,2 mol·dm⁻³ ✓

Accept range/Aanvaar gebied: 1,15 to/tot 1,25 mol·dm⁻³

(1)

- 5.3.4
- Concentration of reactants decreases. ✓
Konsentrasie van reaktanse neem af.
 - Less particles per unit volume. ✓
Minder deeltjies per volume.
 - Less effective collisions per unit time. ✓
Minder effektiewe botsings per eenheidstyd.

(3)

5.3.5

Marking criteria/Nasienriglyne

- Use $n = cV$ to calculate $\Delta n/n(\text{initial})$ & $n(\text{final})$.
Gebruik $n = cV$ om $\Delta n/n(\text{aanvanklik})$ & $n(\text{finaal})$ te bereken.
- $\Delta n(\text{HCl}) = n(\text{final/finaal}) - n(\text{initial/aanvanklik})$.
OR/OF
 $\Delta c(\text{HCl}) = c(\text{final/finaal}) - c(\text{initial/aanvanklik})$
- Use ratio/*Gebruik verhouding* $n(\text{CH}_3\text{Cl}) : n(\text{HCl}) = 1 : 1$
- Substitute/*Vervang* $50,5 \text{ g} \cdot \text{mol}^{-1}$ in $n = \frac{m}{M}$.
- Final answer/*Finale antwoord*: 3,54–4,0 g.

OPTION 1/OPSIE 1

Mol initially/*begin*:

$$\begin{aligned} n(\text{HCl}) &= cV \checkmark \\ &= (1,9)(60 \times 10^{-3}) \checkmark \\ &= 0,11 \text{ mol } (0,114) \end{aligned}$$

Mol final/*finaal*:

$$\begin{aligned} n(\text{HCl}) &= cV \\ &= (0,6)(60 \times 10^{-3}) \\ &= 0,04 \text{ mol } (0,036) \end{aligned}$$

$$\begin{aligned} \Delta n(\text{HCl}) &= 0,04 - 0,11 \checkmark \\ &= -0,07 \text{ mol } (0,078 \text{ mol}) \end{aligned}$$

$$\Delta n(\text{HCl}) = 0,07 \text{ mol } (0,078)$$

$$\begin{aligned} n(\text{formed/gevorm}) &= n(\text{reacted/reageer}) \\ n(\text{CH}_3\text{Cl}) &= n(\text{HCl}) \checkmark \\ &= 0,07 \text{ mol} \end{aligned}$$

$$\begin{aligned} m(\text{CH}_3\text{Cl}) &= nM \\ &= (0,07)(50,5) \checkmark \\ &= 3,54 \text{ g } \checkmark \end{aligned}$$

Accept range/*Aanvaar gebied*:
3,54 – 4,0 g

OPTION 2/OPSIE 2

$$\begin{aligned} \Delta c(\text{HCl}) &= 0,6 - 1,9 \checkmark \\ &= -1,3 \\ &= 1,3 \text{ mol} \cdot \text{dm}^{-3} \end{aligned}$$

$$\begin{aligned} \Delta n(\text{HCl}) &= \Delta cV \\ &= (1,3)(60 \times 10^{-3}) \checkmark \\ &= 0,08 \text{ mol } (0,078) \end{aligned}$$

$$\begin{aligned} n(\text{formed/gevorm}) &= n(\text{reacted/reageer}) \\ n(\text{CH}_3\text{Cl}) &= n(\text{HCl}) \checkmark \\ &= 0,08 \text{ mol} \end{aligned}$$

$$\begin{aligned} m(\text{CH}_3\text{Cl}) &= nM \\ &= (0,08)(50,5) \checkmark \\ &= 4 \text{ g } \checkmark \end{aligned}$$

Accept range/*Aanvaar gebied*:
3,54 – 4,0 g

(5)

[19]

QUESTION 6/VRAAG 6

6.1

<u>OPTION 1/OPSIE 1</u>	<u>OPTION 2/OPSIE 2</u>
$c = \frac{m}{MV} \checkmark$ $= \frac{2,2}{(44)(5)} \checkmark$ $= 0,01 \text{ mol} \cdot \text{dm}^{-3} \checkmark$	$n = \frac{m}{M}$ $= \frac{2,2}{44} \checkmark$ $= 0,05 \text{ mol}$ $c = \frac{n}{V}$ $= \frac{0,05}{5} \checkmark$ $= 0,01 \text{ mol} \cdot \text{dm}^{-3} \checkmark$

Both formulae/
albei formules

(4)

6.2

For equilibrium, a forward and a reverse reaction are needed. ✓
Vir ewewig word 'n voorwaartse en terugwaartse reaksie benodig.

OR/OF

Without CaO(s), the reverse reaction is not possible.
Sonder CaO(s) is die terugwaartse reaksie nie moontlik nie.

OR/OF

If only CO₂ is present, the reverse reaction cannot take place.
Indien slegs CO₂ teenwoordig is, kan die terugwaartse reaksie nie plaasvind nie.

(1)

6.3

CO₂ is a gas and will escape if the container is not sealed. ✓
CO₂ is 'n gas en sal ontsnap as die houer nie geseël is nie.

(1)

6.4

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

Marking guidelines/Nasienriglyne

- K_c expression/K_c-uitdrukking ✓
- Substitute K_c value./Vervang K_c-waarde. ✓
- n(CO₂) or m(CO₂) at equilibrium/n(CO₂) of m(CO₂) by ewewig. ✓
- Change in n(CO₂) or m(CO₂)/Verandering in n(CO₂) of m(CO₂) ✓
- Mol ratio/Molverhouding: n(CaCO₃) : n(CO₂) = 1 : 1 ✓
- n(CaCO₃) x 100 ✓
- Final answer/Finale antwoord: 0,4 g ✓

OPTION 1/OPSIE 1

POSITIVE MARKING FROM QUESTION 6.2.

POSITIEWE NASIEN VANAF VRAAG 6.2.

$$K_c = [\text{CO}_2] \checkmark$$

$$= 0,0108$$

$$\therefore [\text{CO}_2] = 0,0108 \text{ (mol}\cdot\text{dm}^{-3}) \checkmark$$

$$\begin{aligned} n(\text{CO}_2 \text{ at equilibrium/by ewewig}) &= cV \\ &= (0,0108)(5) \checkmark \\ &= 0,054 \text{ mol} \end{aligned}$$

$$\begin{aligned} n(\text{CO}_2 \text{ formed/gevorm}) &= n(\text{CO}_2 \text{ at equilibrium/by ewewig}) - \\ n(\text{CO}_2 \text{ initially/begin}) & \\ &= 0,054 - 0,05 \checkmark \\ &= 0,004 \text{ mol} \end{aligned}$$

$$n(\text{CaCO}_3) = n(\text{CO}_2 \text{ formed}) = 0,004 \text{ mol} \checkmark$$

$$\begin{aligned} m(\text{CaCO}_3) &= nM \\ &= (0,004)(100) \checkmark \\ &= 0,4 \text{ g} \checkmark \end{aligned}$$

OPTION 2/OPSIE 2

POSITIVE MARKING FROM QUESTION 6.2.

POSITIEWE NASIEN VANAF VRAAG 6.2.

$$K_c = [\text{CO}_2] \checkmark$$

$$= 0,0108 \checkmark$$

$$\therefore [\text{CO}_2] = 0,0108 \text{ (mol}\cdot\text{dm}^{-3})$$

	CaCO ₃	CaO	CO ₂
Initial quantity (mol) <i>Aanvangshoeveelheid (mol)</i>	0	0	0,05
Change (mol) <i>Verandering (mol)</i>	0,004	x	0,004 ✓
Quantity at equilibrium (mol) <i>Hoeveelheid by ewewig (mol)</i>			0,054 ✓
Equilibrium concentration (mol·dm ⁻³) <i>Ewewigskonsentrasie (mol·dm⁻³)</i>			0,0108

✓ Ratio/
Verhouding

$$\begin{aligned} m(\text{CaCO}) &= nM \\ &= (0,004)(100) \checkmark \\ &= 0,4 \text{ g} \checkmark \end{aligned}$$

OPTION 3/OPSIE 3

POSITIVE MARKING FROM QUESTION 6.2.

POSITIEWE NASIEN VANAF VRAAG 6.2.

	CaCO ₃	CaO	CO ₂
Initial quantity (mol) <i>Aanvangshoeveelheid (mol)</i>	0	0	0,05
Change (mol) <i>Verandering (mol)</i>	x	x	x ✓
Quantity at equilibrium (mol) <i>Hoeveelheid by ewewig (mol)</i>			0,05 + x ✓
Equilibrium concentration (mol·dm ⁻³) <i>Ewewigskonsentrasie (mol·dm⁻³)</i>			$\frac{0,05 + x}{5}$

✓ Ratio/
Verhouding

$$K_c = [\text{CO}_2] \checkmark$$

$$\therefore 0,0108 \checkmark = \frac{0,05 + x}{5}$$

$$\therefore x = 0,004$$

$$\begin{aligned} m(\text{CaCO}) &= nM \\ &= (0,004)(100) \checkmark \\ &= 0,4 \text{ g } \checkmark \end{aligned}$$

CALCULATIONS USING CONCENTRATIONS:

BEREKENINGE WAT KONSENTRASIE GEBRUIK:

OPTION 4/OPSIE 4

POSITIVE MARKING FROM QUESTION 6.2.

POSITIEWE NASIEN VANAF VRAAG 6.2.

$$\begin{aligned} K_c &= [\text{CO}_2] \checkmark \\ &= 0,0108 \checkmark \end{aligned}$$

$$\therefore [\text{CO}_2] = 0,0108 \text{ (mol·dm}^{-3}\text{)}$$

$$\begin{aligned} \Delta c(\text{CO}_2) &= c(\text{CO}_2 \text{ at equilibrium/by ewewig}) - c(\text{CO}_2 \text{ initially/begin}) \\ &= 0,0108 - 0,01 \checkmark \\ &= 8 \times 10^{-4} \text{ mol·dm}^{-3} \end{aligned}$$

$$\begin{aligned} n(\text{CO}_2 \text{ formed/gevorm}) &= cV \\ &= (8 \times 10^{-4})(5) \checkmark \\ &= 4 \times 10^{-3} \text{ mol} \end{aligned}$$

$$n(\text{CaCO}_3 \text{ formed/gevorm}) = n(\text{CO}_2 \text{ formed/gevorm}) = 4 \times 10^{-3} \text{ mol } \checkmark$$

$$\begin{aligned} m(\text{CaCO}_3) &= nM \\ &= (4 \times 10^{-3})(100) \checkmark \\ &= 0,4 \text{ g } \checkmark \end{aligned}$$

CALCULATIONS USING MASS:

BEREKENINGE WAT MASSA GEBRUIK:

OPTION 5/OPSIE 5

$$K_c = [\text{CO}_2] \checkmark$$

$$= 0,0108 \checkmark$$

$$\therefore [\text{CO}_2] = 0,0108 \text{ (mol}\cdot\text{dm}^{-3}\text{)}$$

$$m(\text{CO}_2) = cMV$$

$$= (0,0108)(44)(5) \checkmark$$

$$= 2,376 \text{ g}$$

$$\Delta m(\text{CO}_2) = m(\text{CO}_2 \text{ at equilibrium/by ewewig}) - m(\text{CO}_2 \text{ initially/begin})$$

$$= 2,376 - 2,2 \checkmark$$

$$= 0,176 \text{ g}$$

$$n(\text{CO}_2 \text{ formed / gevorm}) = \frac{m}{M}$$

$$= \frac{0,176}{44}$$

$$= 4 \times 10^{-3} \text{ mol}$$

$$n(\text{CaCO}_3 \text{ formed/gevorm}) = n(\text{CO}_2 \text{ formed/gevorm}) = 4 \times 10^{-3} \text{ mol} \checkmark$$

$$m(\text{CaCO}_3) = nM$$

$$= (4 \times 10^{-3})(100) \checkmark$$

$$= 0,4 \text{ g} \checkmark$$

(7)

6.5

6.5.1 Remains the same/*Bly dieselfde* ✓

(1)

6.5.2 Decreases/*Neem af* ✓

(1)

6.6 Endothermic/*Endotermies* ✓



- K_c decreases at lower temperature./ *K_c neem af by laer temperatuur.* ✓
- Therefore the product of the concentration of products decreases./*The reverse reaction is favoured.* ✓
Daarom neem die produk van die konsentrasie van die produkte af./die terugwaartse reaksie word bevoordeel.
- A decrease in temperature favours the exothermic reaction. ✓
Afname in temperatuur bevoordeel die eksotermiese reaksie.

OR/OF

Endothermic/*Endotermies* ✓

- K_c increases with increase in temperature. ✓
 K_c neem toe met toename in temperatuur.
- Increase in temperature favours the forward reaction. ✓
Toename in temperatuur bevoordeel die voorwaartse reaksie.
- Increase in temperature favours the endothermic reaction. ✓
Toename in temperatuur bevoordeel die endotermiese reaksie.

(4)

[19]

QUESTION 7/VRAAG 7

7.1 It is a proton/ H_3O^+ ion/ H^+ ion donor. ✓✓
Dit is 'n proton/ H_3O^+ -ioon/ H^+ -ioonskenker. (2)

7.2

7.2.1 $\text{CO}_3^{2-}(\text{aq})$ ✓ **Note/Aantekening:**
Ignore phase/Ignoreer fase (1)

7.2.2 $\text{H}_2\text{CO}_3 + \text{H}_2\text{O} \rightleftharpoons \text{HCO}_3^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq})$ ✓ ✓ bal

Notes/Aantekeninge

- Reactants ✓ Products ✓ Balancing ✓
Reaktanse ✓ Produkte ✓ Balansering ✓
- Ignore/Ignoreer → and phases/en fases
- Marking rule 6.3.10/Nasienreël 6.3.10

(3)

7.2.3

OPTION/OPSIE 1	OPTION/OPSIE 2
<p>pH = -log[H^+] ✓ 3,4 = -log[H^+] ✓ [H^+] = $10^{-3,4} / 3,98 \times 10^{-4} \text{ mol}\cdot\text{dm}^{-3}$</p> <p>[$\text{H}^+$][$\text{OH}^-$] = 10^{-14} ✓ $\therefore [\text{OH}^-] = \frac{1 \times 10^{-14}}{3,98 \times 10^{-4}}$ ✓ = $2,51 \times 10^{-11} \text{ mol}\cdot\text{dm}^{-3}$ ✓</p>	<p>pH + pOH = 14 ✓ 3,4 + pOH = 14 ✓ pOH = 11,6</p> <p style="text-align: center;">↙</p> <p>pOH = -log[OH^-] ✓ 11,6 = -log[OH^-] ✓ [OH^-] = $10^{-11,6} / 2,51 \times 10^{-11} \text{ mol}\cdot\text{dm}^{-3}$ ✓</p>

(5)

7.3

7.3.1 An acid that donates ONE proton/ H^+ / H_3O^+ -ion. ✓
'n Suur wat EEN proton/ H^+ / H_3O^+ -ioon skenk.

OR/OF

An acid of which ONE mol ionises to form ONE mol of protons/ H^+ ions/ H_3O^+ ions.

'n Suur waarvan EEN mol ioniseer om EEN mol protone/ H^+ -ione/ H_3O^+ -ione te vorm.

(1)

7.3.2

<p>OPTION/OPSIE 1</p> $\frac{c_a \times V_a}{c_b \times V_b} = \frac{n_a}{n_b} \checkmark$ $\frac{c_a \times 25}{0,1 \times 27,5} = \frac{1}{1} \checkmark$ $c_a = 0,11 \text{ mol} \cdot \text{dm}^{-3} \checkmark$	<p>Marking guidelines/Nasienriglyne:</p> <ul style="list-style-type: none"> • Formula./ Formule. • Substitution of/Substitusie van $c_a \times 25$. • Substitution of/Substitusie van $0,1 \times 27,5$ • Use mol ratio/Gebruik molverhouding 1:1. • Final answer/Finale antwoord: $0,11 \text{ mol} \cdot \text{dm}^{-3}$
<p>OPTION/OPSIE 2</p> $n(\text{NaOH}) = cV \checkmark$ $= 0,1 \times 0,0275 \checkmark$ $= 0,00275 \text{ mol}$ $n(\text{acid X}) = n(\text{NaOH})$ $= 0,00275 \text{ mol} \checkmark$ $c(\text{acid X}) = \frac{n}{V}$ $= \frac{2,75 \times 10^{-3}}{0,025} \checkmark$ $= 0,11 \text{ mol} \cdot \text{dm}^{-3} \checkmark$	<p>Marking guidelines/Nasienriglyne:</p> <ul style="list-style-type: none"> • $n = cV$ • Substitution into $n = cV$ to calculate $n(\text{NaOH})$. <i>Substitusie in $n = cV$ om $n(\text{NaOH})$ te bereken.</i> • Use mol ratio 1:1. <i>Gebruik molverhouding 1:1.</i> • Substitution into $c = \frac{n}{V}$ to calculate $c(\text{acid})$. <i>Substitusie in $c = \frac{n}{V}$ om $c(\text{suur})$ te berei.</i> • Final answer: $0,11 \text{ mol} \cdot \text{dm}^{-3}$ <i>Finale antwoord: : $0,11 \text{ mol} \cdot \text{dm}^{-3}$</i>

(5)

7.3.3 Weak/Swak ✓



The $[\text{H}^+]$ OR $[\text{H}_3\text{O}^+]$ is lower than the concentration of acid X. ✓
Therefore the acid is incompletely ionised. ✓

*Die $[\text{H}^+]$ OF $[\text{H}_3\text{O}^+]$ is laer as die konsentrasie van suur X.
Daarom is die suur onvolledig geïoniseer.*

(3)

[20]

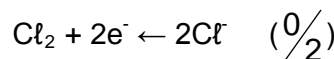
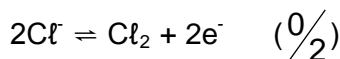
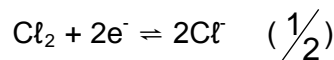
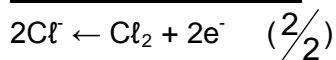
QUESTION 8/VRAAG 8

8.1 B ✓ (1)

8.2

8.2.1 $\text{Cl}_2(\text{g}) + 2\text{e}^- \rightarrow 2\text{Cl}^-(\text{aq})$ ✓✓

Notes/Aantekeninge:



(2)

8.2.2 Cl_2 / Chlorine / Chloor ✓

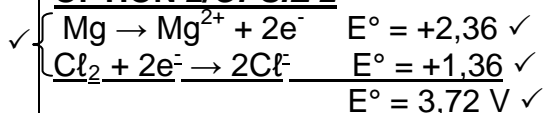
(1)

8.3

OPTION 1/OPSIE 1

$E_{\text{cell}}^{\ominus} = E_{\text{cathode}}^{\ominus} - E_{\text{anode}}^{\ominus}$ ✓
 $= 1,36$ ✓ $-(-2,36)$ ✓
 $= 3,72 \text{ V}$ ✓

OPTION 2/OPSIE 2



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. $E^{\ominus}_{\text{cell}} = E^{\ominus}_{\text{OA}} - E^{\ominus}_{\text{RA}}$ followed by correct substitutions./Enige ander formule wat onkonvensionele afkortings gebruik, bv. $E^{\ominus}_{\text{sel}} = E^{\ominus}_{\text{OM}} - E^{\ominus}_{\text{RM}}$ gevolg deur korrekte vervangings: $\frac{3}{4}$

(4)

- 8.4
- The Mg electrode becomes smaller./The mass of the Mg electrode decreases./Mg electrode being corroded. ✓
Die Mg elektrode word kleiner./Die massa van die Mg-elektrode neem af./Mg elektrode word weggevreet.
 - Magnesium is oxidised./ $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$ ✓
Magnesium word geoksideer./ $\text{Mg} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$

(2)

[10]

QUESTION 9/VRAAG 9

9.1 Electrolytic cell/Elektrolitiese sel ✓

(1)

9.2 The substance/species which loses electrons. ✓✓
Die stof/spesie wat elektrone verloor.

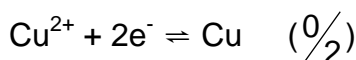
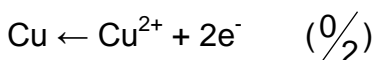
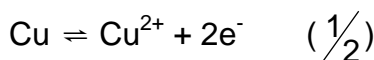
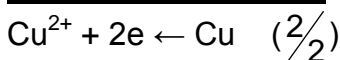
(2)

9.3 P ✓

(1)

9.4 $\text{Cu}(\text{s}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{e}^-$ ✓✓

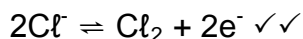
Notes/Aantekeninge:



(2)

- 9.5 A ✓
Cl⁻ ions move to the positive electrode/anode where they are oxidised to Cl₂. ✓✓
Cl⁻ ione beweeg na die positiewe electrode/anode waar dit geoksideer word na Cl₂.

OR/OF



(3)
[9]

QUESTION 10/VRAAG 10

- 10.1 Ostwald process/-proses ✓ (1)
- 10.2 NO/nitrogen monoxide/stikstofmonoksied ✓ (2)
Water/H₂O ✓
- 10.3 NH₃ + HNO₃ ✓ → NH₄NO₃ ✓ ✓ bal

Notes/Aantekeninge:

- Reactants ✓ Products ✓ Balancing ✓
Reaktanse ✓ Produkte ✓ Balansering ✓
- Ignore/Ignoreer → and phases/en fases
- Marking rule 6.3.10/Nasienreël 6.3.10

(3)

10.4

OPTION 1/OPTION 1	OPTION 2/OPSIE 2
$n(\text{NH}_3) = \frac{m}{M}$ $= \frac{6,8 \times 10^7}{17} \checkmark$ $= 4 \times 10^6 \text{ mol}$ <p style="text-align: center;">↓</p> $n(\text{NH}_4\text{NO}_3) = n(\text{NH}_3)$ $= 4 \times 10^6 \text{ mol}$ $m(\text{NH}_4\text{NO}_3) = nM$ $= (4 \times 10^6)(80) \checkmark$ $= 3,2 \times 10^8 \text{ g}$ $= 3,2 \times 10^5 \text{ kg} \checkmark$	$m(\text{NH}_4\text{NO}_3) = \frac{6,8 \times 10^4}{17} \times 80 \checkmark \checkmark$ $= 3,2 \times 10^5 \text{ kg} \checkmark$
	OPTION 3/OPSIE 3
	<p>17 g ✓ NH₃ forms/vorm 80 g ✓ NH₄NO₃</p> <p>6,8 x 10⁴ kg forms/vorm x g NH₄NO₃</p> $x = 6,8 \times 10^4 \times \frac{80}{17}$ $= 3,2 \times 10^5 \text{ kg} \checkmark$

(3)

- 10.5 To make a NPK fertiliser/fertilisers which contain all three primary nutrients. ✓
Om 'n NPK-kunsmisstof/kunsmisstowwe wat al drie primêre voedingstowwe bevat, te maak.

(1)
[10]

TOTAL/TOTAAL: 150