



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 2018

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

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

QUESTION 1/VRAAG 1

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

QUESTION 2/VRAAG 2

- 2.1
- 2.1.1 A ✓ (1)
- 2.1.2 B ✓ (1)
- 2.1.3 D ✓ (1)
- 2.1.4 D ✓ (1)
- 2.2
- 2.2.1 Butanal/Butanaal ✓ (1)
- 2.2.2 5-ethyl-6,6-dimethyloctan-3-ol/5-*etiel*-6,6-*dimetieloktan*-3-ol

OR/OF

5-ethyl-6,6-dimethyl-3-octanol/5-*etiel*-6,6-*dimetiel*-3-*oktanol*

Marking criteria/Nasienriglyne:

- Stem, i.e. octan./*Stam d.i. oktan.* ✓
- Correct functional group, i.e. –ol./*Korrekte funksionele groep d.i. –ol.* ✓
- Two methyl groups and one ethyl group.
Twee metielgroepe en een etielgroep. ✓
- Correct numbering of substituents and functional group ✓
Korrekte nommering van substituenten en funksionele groep.

IF/INDIEN:

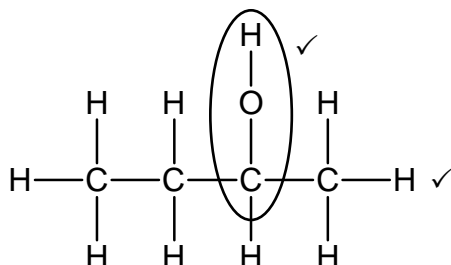
Any error e.g. hyphens omitted and/or incorrect sequence:

Enige fout bv. koppeltekens weggelaat en/of verkeerde volgorde: Max./Maks. $\frac{3}{4}$ (4)

- 2.3 Compounds with the same molecular formula, ✓ but different positions of the side chain/substituents/functional groups on parent chain. ✓
Verbindings met dieselfde molekulêre formule, maar verskillende posisies van die syketting/substituente/funksionele groepe op die stamketting. (2)

2.4

2.4.1

**Marking criteria/Nasienriglyne:**

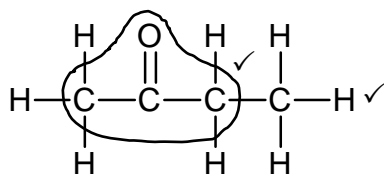
- Whole structure correct:
Hele struktuur korrek: $\frac{2}{2}$
- Only functional group correct:/Slegs funksionele groep korrek: Max/Maks.: $\frac{1}{2}$

IF/INDIEN:

- More than one functional group:
Meer as een funksionele groep: $\frac{0}{2}$

(2)

2.4.2

**Marking criteria/Nasienriglyne:**

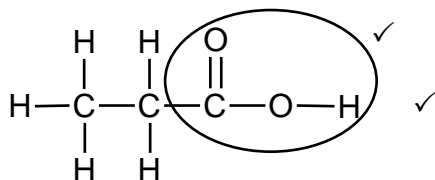
- Whole structure correct:
Hele struktuur korrek: $\frac{2}{2}$
- Only functional group correct:/Slegs funksionele groep korrek: Max/Maks.: $\frac{1}{2}$

IF/INDIEN:

- More than one functional group:
Meer as een funksionele groep: $\frac{0}{2}$

(2)

2.4.3

**Marking criteria/Nasienriglyne:**

- Whole structure correct:
Hele struktuur korrek: $\frac{2}{2}$
- Only functional group correct:/Slegs funksionele groep korrek: Max/Maks.: $\frac{1}{2}$

IF/INDIEN:

- More than one functional group:
Meer as een funksionele groep: $\frac{0}{2}$

(2)

[17]

QUESTION 3/VRAAG 3

3.1 150 kPa ✓ (1)

3.2

3.2.1 The temperature at which the vapour pressure equals atmospheric/external pressure. ✓✓ (2 or 0)
Die temperatuur waar die dampdruk gelyk is aan atmosferiese/eksterne druk. (2)

3.2.2 55 °C ✓ (1)

3.3

3.3.1 Z ✓ (1)

3.3.2

- Carboxylic acids have, in addition to London forces and dipole-dipole forces, two sites for hydrogen bonding between molecules. ✓
Karboksielsure het, in toevoeging tot Londonkragte en dipool-dipoolkragte, twee punte vir waterstofbinding tussen molekule.
OR/OF
Carboxylic acids can form dimers due to strong hydrogen bonding between molecules.
Karboksielsure kan dimere vorm as gevolg van sterk waterstofbindings tussen molekule.
- Alcohols have, in addition to London forces and dipole-dipole forces, one site for hydrogen bonding between molecules. ✓
Alkohole het, in toevoeging tot Londonkragte en dipool-dipoolkragte, een punt vir waterstofbinding tussen molekule.
- Ketones has, in addition to London forces, dipole-dipole forces between molecules. ✓
Ketone het, in toevoeging tot Londonkragte, dipool-dipoolkragte tussen molekule.
- Intermolecular forces in carboxylic acids is the strongest./Most energy needed to overcome/break intermolecular forces in ethanoic acid. ✓
Intermolekulêre kragte in karboksielsure is die sterkste./Die meeste energie word benodig om intermolekulêre kragte in karboksielsure te oorkom/breek. (4)

3.3.3 Propanone/Propanoon ✓

OR/OF

Propan-2-one/Propan-2-oon

OR/OF

2-propanone/2-propanoon

(1)
[10]

QUESTION 4/VRAAG 4

4.1 The chemical process in which longer chain hydrocarbon molecules are broken down ✓ to shorter more useful molecules. ✓
Die chemiese proses waarin langer ketting koolwaterstofmolekule afgebreek word in korter meer bruikbare molekule. (2)

4.2

4.2.1 III ✓ (1)

4.2.2 II ✓ (1)

4.2.3 I ✓ (1)

4.3

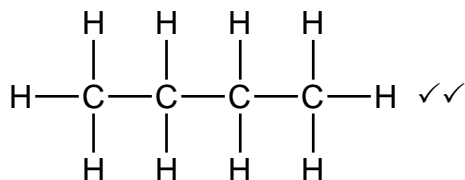
4.3.1 Heat/Light /UV light ✓
Hitte/Lig/UV Lig (1)

4.3.2 P or/of S ✓ (1)

4.3.3 Ethene/Eteen ✓ (1)

4.3.4 C_8H_{18} ✓✓ (Correct Structural formula/Korrekte struktuurformule : $\frac{1}{2}$) (2)

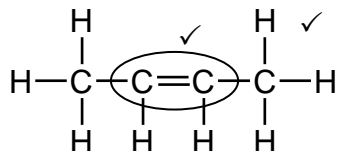
4.3.5

**Marking criteria/Nasienriglyne:**

- Whole structure correct:
Hele struktuur korrek: $\frac{2}{2}$
- 4 C atoms in chain:/4 C-atome in ketting:
 Max/Maks.: $\frac{1}{2}$
- Correct condensed formula/Korrekte gekondenseerde formule: $\frac{1}{2}$

(2)

4.3.6

**Marking criteria/Nasienriglyne:**

- Whole structure of alkene/haloalkane correct:
Hele struktuur van alkeen/haloalkaan korrek: $\frac{2}{2}$
- Only functional group correct/Slegs funksionele groep korrek: $\frac{1}{2}$
- Correct condensed structure/Korrekte gekondenseerde struktuur:
 $CH_3CH=CHCH_3$ $\frac{1}{2}$

(2)

[14]

QUESTION 5/VRAAG 5**5.1 ONLY ANY ONE OF/SLEGS ENIGE EEN VAN:**

- Change in concentration ✓ of a reactant/product per unit time. ✓
Verandering in konsentrasie van reaktanse/produkte per eenheidtyd.
- Rate of change in concentration. ✓✓
Tempo van verandering in konsentrasie.
- *Change in amount/number of moles/volume/mass of products/reactants per (unit) time./Verandering in hoeveelheid/getal mol/volume/massa van produkte/reaktanse per (eenheid)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 reaktanse gebruik per (eenheid)tyd.*

(2)

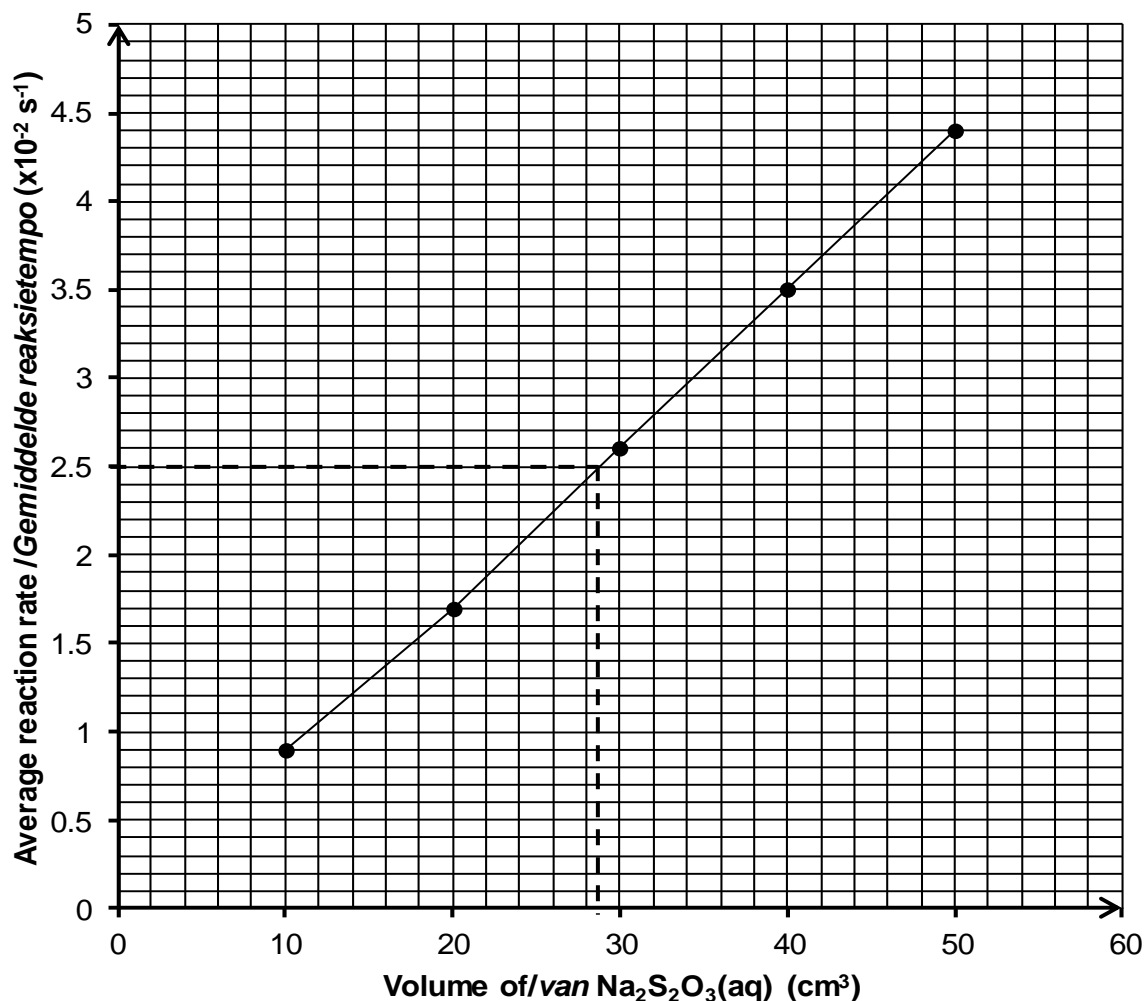
5.2 More than/Groter as ✓**Accept/Aanvaar**

Equal to/Gelyk aan

(1)

5.3

Graph of average reaction rate versus volume of $\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$
Grafiek van gemiddelde reaksietempo teenoor volume $\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$

**Marking criteria/Nasienriglyne:**

Any 3 points correctly plotted./Enige 3 punte korrek gestip. ✓

All (5) points correctly plotted./Alle (5) punte korrek gestip. ✓

Straight line drawn./Reguitlyn getrek. ✓

(3)

5.4

5.4.1

Marking criteria/Nasienriglyne:
y axis/y-as: $2,5 \times 10^{-2} \text{ s}^{-1}$ ✓
Dotted line drawn from the y-axis to the x-axis as shown. ✓ <i>Stippellyn getrek van y-as na x-as soos getoon.</i>
$V = 28 \text{ to } 30 \text{ cm}^3$ ✓

(3)

5.4.2

Criteria for conclusion/Riglyne vir gevolgtrekking:	
Dependent and independent variables correctly identified. <i>Afhanklike en onafhanklike veranderlikes korrek geïdentifiseer.</i>	✓
Relationship between the independent and dependent variables correctly stated./ <i>Verwantskap tussen die afhanklike en onafhanklike veranderlikes korrek genoem.</i>	✓

Examples/Voorbeelde:

- Reaction rate of reaction increases with an increase in concentration/volume of sodium thiosulphate.
Reaksietyempo neem toe met 'n toename in konsentrasie/volume van natriumtiosulfaat.
- Reaction rate decreases with a decrease in concentration/volume of sodium thiosulphate.
Reaksietyempo neem af met 'n afname in konsentrasie/volume van natriumtiosulfaat.
- Reaction rate is (directly) proportional to concentration/volume of sodium thiosulphate.
Reaksietyempo is (direk) eweredig aan konsentrasie/volume van natriumtiosulfaat.

(2)

5.5

- More($\text{Na}_2\text{S}_2\text{O}_3$) particles per unit volume. ✓
Meer $\text{Na}_2\text{S}_2\text{O}_3$ -deeltjies per eenheid volume.
- More effective collisions per unit time./Higher frequency of effective collisions. ✓
Meer effektiewe botsings per eenheid tyd./Hoër frekwensie van effektiewe botsings.
- Increase in reaction rate./*Toename in reaksietyempo.* ✓

(3)

5.6

OPTION 1/OPSIE 1	Marking criteria/Nasienriglyne:
$n(\text{S})_{\text{produced/gevorm}} = \frac{m}{M}$ $= \frac{1,62}{32} \checkmark$ $= 0,0506 \text{ mol}$	<ul style="list-style-type: none"> • Substitute/Vervang 32 in $n = \frac{m}{M}$ ✓ • Use ratio/Gebruik verhouding: $\text{Na}_2\text{S}_2\text{O}_3: \text{S} = 1 : 1$ ✓ • Substitute/Vervang 158 in $n = \frac{m}{M}$ ✓ • Final answer/Finale antwoord: 7,90 to/tot 8,06 g ✓
$n(\text{Na}_2\text{S}_2\text{O}_3) = n(\text{S}) = 0,0506 \text{ mol} \checkmark$	
$n(\text{Na}_2\text{S}_2\text{O}_3) = \frac{m}{M}$ $0,0506 = \frac{m}{158} \checkmark$ $\therefore m(\text{Na}_2\text{S}_2\text{O}_3) = 7,99 \text{ g} \checkmark$ [Range/Gebied: 7,90 to 8,06]	OPTION 2/OPSIE 2 $158 \text{ g} \checkmark \text{Na}_2\text{S}_2\text{O}_3 \longrightarrow 32 \text{ g} \checkmark \text{S}$ $\therefore x \longrightarrow 1,62 \text{ g} \checkmark \text{S}$ $x = \frac{158 \times 1,62}{32} = 7,99 \text{ g} \checkmark$ [Range/Gebied: 7,90 to 8,06]

(4)

[18]

QUESTION 6/VRAAG 6

6.1

6.1.1 When the equilibrium in a closed system is disturbed, the system will re-instate a new equilibrium by favouring the reaction that will oppose the disturbance. ✓✓

Wanneer die ewewig in 'n geslote sisteem versteur word, stel die sisteem 'n nuwe ewewig in deur die reaksie wat die versteuring teenwerk, te bevoordeel. (2)

6.1.2 • Percentage yield increases with an increase in temperature. ✓
Persentasie opbrengs verhoog met toename in temperatuur.

• Forward reaction is favoured. ✓

Voorwaartse reaksie word bevoordeel.

• Increase in temperature favours an endothermic reaction. ✓

Toename in temperatuur bevoordeel die endotermiese reaksie. (3)

6.1.3 When the pressure increases, the reaction that leads to a decrease in the number of moles will be favoured. ✓✓

Wanneer die druk verhoog, word die reaksie wat tot 'n afname in die aantal mol lei, bevoordeel.

Accept/Aanvaar

When the pressure increases, the yield increases ✓ because the equilibrium position shifts to the right. ✓

Wanneer die druk toeneem, neem die opbrengs toe omdat die ewewigsposisie na regs skuif. (2)

6.1.4 I ✓✓ (2)

6.2

Mark allocation/Puntetoekenning

- Substitution of/Vervanging van $36,5 \text{ g} \cdot \text{mol}^{-1}$ in $n = \frac{m}{M}$. ✓
- Change/Verandering $n(\text{HCl}) = \text{initial/aanvanklik} - \text{equilibrium/ewewig}$. ✓
- USING ratio/GEBRUIK verhouding: 4 : 1 : 2 : 2 ✓
- Equilibrium: $n(\text{O}_2)$ & $n(\text{H}_2\text{O})$ & $n(\text{Cl}_2) = \text{initial} \pm \text{change}$ ✓
Ewewig: : $n(\text{O}_2)$ & $n(\text{H}_2\text{O})$ & $n(\text{Cl}_2) = \text{aanvanklik} \pm \text{verandering}$
- Divide by volume/Gedeel deur volume ($0,2 \text{ dm}^3$) ✓
- Correct K_c expression (formulae in square brackets). ✓
Korrekte K_c -uitdrukking (formules tussen vierkanthakies).
- Substitution of reactant concentrations/Vervanging van reaktanskonsentrasies. ✓
- Substitution of product concentrations./Vervanging van produk-konsentrasies. ✓
- Final answer/Finale antwoord: 13,966 to/tot 18,72 ✓
Range/Gebied: 13,966 to/tot 18,72

OPTION 1/OPSIE 1

	HCl	O ₂	Cl ₂	H ₂ O	
Initial quantity/Aanvangshoeveelheid (mol)	0,2	0,11	0	0	
Change/Verandering (mol)	0,15 ✓	0,0375	0,075	0,075	ratio ✓ verhouding
Quantity at equilibrium/Hoeveelheid by ewewig (mol)	$\frac{1,825}{36,5} = 0,05$ ✓	0,0725	0,075	0,075	✓
Equilibrium concentration/Ewewigskonsentrasie (mol·dm ⁻³)	0,25	0,3625	0,375	0,375	Divide by 0,2 ✓ Deel deur 0,2

$$K_c = \frac{[\text{Cl}_2]^2 [\text{H}_2\text{O}]^2}{[\text{HCl}]^4 [\text{O}_2]} \checkmark = \frac{(0,375)^2 (0,375)^2}{(0,25)^4 (0,3625)} \checkmark = 13,97 \checkmark$$

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

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

Wrong K_c expression/Verkeerde K_c-uitdrukking: Max./Maks. $\frac{5}{9}$

(9)

OPTION 2/OPSIE 2:

$$n(\text{HCl})_{\text{equilibrium/ewewig}} = \frac{m}{M} = \frac{1,825}{36,5} \checkmark = 0,05 \text{ mol}$$

$$n(\text{HCl})_{\text{reacted/reageer}} = 0,2 - 0,05 = 0,15 \text{ mol} \checkmark$$

$$\left. \begin{aligned} n(\text{O}_2)_{\text{reacted/reageer}} &= \frac{1}{4}n(\text{HCl})_{\text{reacted/reageer}} = \frac{1}{4} \times 0,15 = 0,0375 \text{ mol} \\ n(\text{Cl}_2)_{\text{formed/gevorm}} &= \frac{1}{2}n(\text{HCl})_{\text{reacted/reageer}} = \frac{1}{2} \times 0,15 = 0,075 \text{ mol} \\ n(\text{H}_2\text{O})_{\text{formed/gevorm}} &= \frac{1}{2}n(\text{HCl})_{\text{reacted/reageer}} = \frac{1}{2} \times 0,15 = 0,075 \text{ mol} \end{aligned} \right\} \text{Using ratio} \checkmark$$

$$\left. \begin{aligned} n(\text{O}_2)_{\text{equilibrium/ewewig}} &= 0,11 - 0,0375 = 0,0725 \text{ mol} \\ n(\text{Cl}_2)_{\text{equilibrium/ewewig}} &= n(\text{H}_2\text{O})_{\text{equilibrium/ewewig}} = 0,075 \text{ mol} \end{aligned} \right\} \checkmark$$

$$c(\text{O}_2)_{\text{equilibrium/ewewig}} = \frac{n}{V} = \frac{0,0375}{0,2} = 0,3625 \text{ mol} \cdot \text{dm}^{-3}$$

$$\left. \begin{aligned} c(\text{Cl}_2)_{\text{equilibrium/ewewig}} &= c(\text{H}_2\text{O})_{\text{equilibrium/ewewig}} = \frac{n}{V} \\ &= \frac{0,075}{0,2} = 0,375 \text{ mol} \cdot \text{dm}^{-3} \end{aligned} \right\} \text{Divide by/} \\ \text{deel deur } 0,2 \checkmark$$

$$K_c = \frac{[\text{H}_2\text{O}]^2 [\text{Cl}_2]^2}{[\text{HCl}]^4 [\text{O}_2]} \checkmark = \frac{(0,375)^2 (0,375)^2}{(0,25)^4 (0,3625)} \checkmark = 13,97 \checkmark$$

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. $\frac{5}{9}$

(9)

CALCULATIONS USING CONCENTRATIONS
BEREKENINGE WAT KONSENTRASIES GEBRUIK

Mark allocation/Puntetoekening

- Substitution of/Vervanging van $36,5 \text{ g} \cdot \text{mol}^{-1} \ n = \frac{m}{M}$. ✓
- Initial concentration of reactants/Aanvanklike konsentrasie van reaktanse:
 $c(\text{HCl}) = 1,0$ & $c(\text{O}_2) = 0,55 \text{ mol} \cdot \text{dm}^{-3}$ ✓
- Change: $c(\text{HCl}) = 0,75 \text{ mol} \cdot \text{dm}^{-3}$ (initial – equilibrium) ✓
 Verandering: $c(\text{HCl}) = 0,75 \text{ mol} \cdot \text{dm}^{-3}$ (aanvanklik – ewewig)
- USING ratio/GEBRUIK verhouding: 4 : 1 : 2 : 2 ✓
- Equilibrium/Ewewig: $c(\text{H}_2\text{O}) = c(\text{Cl}_2) = 0,3625 \text{ mol} \cdot \text{dm}^{-3}$ (initial+change) and $c(\text{O}_2) = 0,3625 \text{ mol} \cdot \text{dm}^{-3}$ (initial – change) ✓
 Ewewig: $c(\text{H}_2\text{O}) = c(\text{Cl}_2) = 0,3625 \text{ mol} \cdot \text{dm}^{-3}$ (aanvanklik + verandering) en $c(\text{O}_2) = 0,0,3625 \text{ mol} \cdot \text{dm}^{-3}$ (aanvanklik – verandering)
- Correct K_c expression (formulae in square brackets). ✓
 Korrekte K_c -uitdrukking (formules tussen vierkanthakies).
- Substitution of reactant concentrations./Vervanging van reaktanskonsentrasies. ✓
- Substitution of product concentrations./Vervanging van produkonsentrasies. ✓
- Final answer/Finale antwoord: 13,97 ✓
 Range/Gebied: 13,966 to/tot 18,72

OPTION 3/OPSIE 3

$$\begin{aligned} n(\text{HCl})_{\text{equilibrium/ewewig}} &= \frac{m}{M} \\ &= \frac{1,825}{36,5} \checkmark \\ &= 0,05 \text{ mol} \end{aligned}$$

	HCl	O ₂	H ₂ O	Cl ₂	
Initial concentration/ Aanvangskonsentrasie (mol·dm ⁻³)	1,0 ✓	0,55	0	0	Divide by 0,2 ✓ Deel deur 0,2
Change in concentration Verandering in konsentrasie (mol·dm ⁻³)	0,75 ✓	0,1875	0,375	0,375	ratio ✓ verhouding
Equilibrium concentration Ewewigskonsentrasie (mol·dm ⁻³)	0,25	0,3625	0,375	0,375	✓

$$K_c = \frac{[\text{Cl}_2]^2 [\text{H}_2\text{O}]^2}{[\text{HCl}]^4 [\text{O}_2]} \checkmark = \frac{(0,375)^2 (0,375)^2 \checkmark}{(0,25)^4 (0,3625) \checkmark} = 13,97 \checkmark$$

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. $\frac{5}{9}$

QUESTION 7/VRAAG 7

7.1

7.1.1 H₂O ✓HSO₄⁻ ✓

(2)

7.1.2 Strong/Sterk ✓

Completely ionised (in water)./Volledig geïoniseer (in water). ✓

(2)

7.2

7.2.1

Marking Criteria/Nasienriglyne

- Formula/Formule: $\frac{c_a \times V_a}{c_a \times V_b} = \frac{n_a}{n_b} / c = \frac{n}{V}$ ✓
- Substitute/Vervang 0,15 x 24 **OR/OF** 0,15 x 0,024 ✓
- Use/Gebruik 26 cm³ **OR/OF** 0,026 dm³ ✓
- Use mole ratio/Gebruik molverhouding: 1:2 ✓
- Final answer/Finale antwoord: 0,28 mol·dm⁻³ ✓ (0.2769... mol·dm⁻³)

OPTION 1/OPSIE 1

$$\frac{c_a \times V_a}{c_a \times V_b} = \frac{n_a}{n_b} \quad \checkmark$$

$$\frac{0,15 \times 24}{c_b \times 26} = \frac{1}{2} \quad \checkmark$$

$$c(\text{NaOH}) = 0,28 \text{ mol} \cdot \text{dm}^{-3} \quad \checkmark$$

OPTION 2/OPSIE 2

$$\begin{aligned} n(\text{H}_2\text{SO}_4) &= cV \quad \checkmark \\ &= (0,15)(0,024) \quad \checkmark \\ &= 3,6 \times 10^{-3} \text{ mol} \end{aligned}$$

$$\begin{aligned} n(\text{NaOH}) &= 2(3,6 \times 10^{-3}) \quad \checkmark \\ &= 7,2 \times 10^{-3} \text{ mol} \end{aligned}$$

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

$$\begin{aligned} &= \frac{7,2 \times 10^{-3}}{0,026} \quad \checkmark \\ &= 0,28 \text{ mol} \cdot \text{dm}^{-3} \quad \checkmark \end{aligned}$$

(5)

7.2.2

Marking Criteria/Nasienriglyne

- Calculate/Bereken $n(\text{NaOH})$: $0,02 \times 0,28$ ✓
- Calculate/Bereken $n(\text{H}_2\text{SO}_4)$: $0,03 \times 0,15$ ✓
- Use ratios/Gebruik *molverhouding*: $n(\text{H}_2\text{SO}_4) = \frac{1}{2}n(\text{NaOH})$ ✓
- $n(\text{H}_2\text{SO}_4)_{\text{excess}} = n(\text{H}_2\text{SO}_4)_{\text{initial}} - n(\text{H}_2\text{SO}_4)_{\text{used}} = 0,0045 - 0,0028$ ✓
- Substitute/Vervang $0,05 \text{ dm}^3$ in $c = \frac{n}{V}$ ✓
- Substitution/Vervang $2 \times 0,034$ in $2[\text{H}_2\text{SO}_4]$ ✓
- Formula/Formule: $-\log[\text{H}_3\text{O}^+]$ **OR/OF** Substitute/Vervang: $-\log(0,068)$ ✓
- Final answer: 1,10 to/tot 1,167 ✓

OPTION 1/OPTION 1

$$\begin{aligned}
 n(\text{NaOH}) &= cV \\
 &= 0,02 \times 0,28 \quad \checkmark \\
 &= 0,0056 \text{ mol} \\
 n(\text{H}_2\text{SO}_4) &= 0,03 \times 0,15 \quad \checkmark \\
 &= 0,0045 \text{ mol} \\
 n(\text{H}_2\text{SO}_4)_{\text{used}} &= \frac{1}{2}n(\text{NaOH}) \quad \checkmark \\
 &= 0,0028 \\
 n(\text{H}_2\text{SO}_4)_{\text{excess}} &= 0,0045 - 0,0028 \quad \checkmark \\
 &= 0,0017 \text{ mol} \\
 [\text{H}_2\text{SO}_4] &= \frac{n}{V} = \frac{0,0017}{0,05} \quad \checkmark \\
 &= 0,034 \text{ mol} \cdot \text{dm}^{-3} \\
 [\text{H}_3\text{O}^+] &= 2[\text{H}_2\text{SO}_4] \quad \checkmark \\
 &= 2 \times 0,034 \quad \checkmark \\
 &= 0,068 \text{ mol} \cdot \text{dm}^{-3} \\
 \text{pH} &= -\log[\text{H}_3\text{O}^+] \quad \text{OR/OF} \quad -\log(0,068) \quad \checkmark \\
 &= 1,17 \quad \checkmark \quad (1,167)
 \end{aligned}$$

OPTION 2/OPTION 2

$$\begin{aligned}
 n(\text{NaOH}) &= cV \\
 &= 0,02 \times 0,28 \quad \checkmark \\
 &= 0,0056 \text{ mol} \\
 n(\text{H}_2\text{SO}_4) &= 0,03 \times 0,15 \quad \checkmark \\
 &= 0,0045 \text{ mol} \\
 n(\text{H}_3\text{O}^+) &= 2n(\text{H}_2\text{SO}_4) \quad \checkmark \\
 &= 2 \times 0,0045 \\
 &= 0,009 \text{ mol} \\
 n(\text{H}_3\text{O}^+)_{\text{excess}} &= 0,009 - 0,0045 \quad \checkmark \\
 &= 0,0034 \text{ mol} \\
 c(\text{H}_3\text{O}^+) &= \frac{n}{V} \\
 &= \frac{0,0034}{0,05} \quad \checkmark \\
 &= 0,068 \text{ mol} \cdot \text{dm}^{-3} \\
 \text{pH} &= -\log[\text{H}_3\text{O}^+] \quad \text{OR/OF} \quad -\log(0,068) \quad \checkmark \\
 &= 1,17 \quad \checkmark \quad (1,167)
 \end{aligned}$$

(8)
[17]

QUESTION 8/VRAAG 8

8.1

8.1.1 A substance that loses/donates electrons./'n Stof wat elektrone verloor/skenk.
✓✓ (2 or 0) (2)

8.1.2 Platinum/Pt ✓ (1)

8.1.3 $\text{Sn}^{2+}(\text{aq})$ /tin(II) ions/*tin(II)-ione* ✓ (1)

8.1.4 $\text{Pt} | \text{Sn}^{2+}(\text{aq}), \text{Sn}^{4+}(\text{aq}) || \text{Ag}^+(\text{aq}) | \text{Ag}(\text{s})$

OR/OF

$\text{Pt} | \text{Sn}^{2+}(1 \text{ mol} \cdot \text{dm}^{-3}), \text{Sn}^{4+}(1 \text{ mol} \cdot \text{dm}^{-3}) || \text{Ag}^+(1 \text{ mol} \cdot \text{dm}^{-3}) | \text{Ag}(\text{s})$

ACCEPT/AANVAAR

$\text{Pt} | \text{Sn}^{2+} | \text{Sn}^{4+} || \text{Ag}^+ | \text{Ag}$ (3)

8.1.5

OPTION 1/OPSIE 1	Notes/Aantekeninge
$E_{\text{cell}}^{\theta} = E_{\text{reduction}}^{\theta} - E_{\text{oxidation}}^{\theta} \checkmark$ $= +0,80 \checkmark - (+0,15) \checkmark$ $= 0,65 \text{ V} \checkmark$	<ul style="list-style-type: none"> Accept any other correct formula from the data sheet./Aanvaar enige ander korrekte formule vanaf gewensblad. Any other formula using unconventional abbreviations, e.g. $E_{\text{cell}}^{\theta} = E_{\text{OA}}^{\theta} - E_{\text{RA}}^{\theta}$ followed by correct substitutions:/Enige ander formule wat onkonvensionele afkortings gebruik bv. $E_{\text{sel}}^{\theta} = E_{\text{OM}}^{\theta} - E_{\text{RM}}^{\theta}$ gevolg deur korrekte vervangings: Max/Maks: $\frac{3}{4}$
OPTION 2/OPSIE 2	
$\checkmark \left\{ \begin{array}{l} \text{Ag}^+(\text{aq}) + \text{e}^- \rightarrow \text{Ag}(\text{s}) \\ \text{Sn}^{2+}(\text{aq}) \rightarrow \text{Sn}^{4+}(\text{aq}) + 2\text{e}^- \end{array} \right. \begin{array}{l} 0,80 \text{ V} \checkmark \\ -0,15 \text{ V} \checkmark \end{array}$ $2\text{Ag}^+(\text{aq}) + \text{Sn}^{2+}(\text{aq}) \rightarrow \text{Sn}^{4+}(\text{aq}) + 2\text{Ag}(\text{s}) \quad 0,65 \text{ V} \checkmark$	(4)

8.2

8.2.1 Magnesium becomes smaller./Brown solid forms/Mg disappears/eaten away/Mg changes colour. ✓
Magnesium word kleiner./Bruin vaste stof vorm/Mg verdwyn/weggevreet/Mg verander van kleur. (1)

8.2.2 Cu^{2+} is a stronger oxidising agent ✓ (than Mg^{2+}) and will be reduced to ✓
Cu. ✓
 Cu^{2+} is 'n sterker oksideermiddel (as Mg^{2+}) en sal na Cu gereduseer word.

OR/OF

Mg is a stronger reducing agent ✓ (than Cu) and will reduce Cu^{2+} to Cu.
Mg is 'n sterker reduseermiddel (as Cu) en sal Cu^{2+} na Cu reduseer.

(3)
[15]

QUESTION 9/VRAAG 9

- 9.1 The chemical process in which electrical energy is converted to chemical energy. ✓✓
'n Chemiese proses waarin elektriese energie omgeskakel word na chemiese energie.

OR/OF

The use of electrical energy to produce a chemical change.

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

(2)

- 9.2 B ✓

(1)

- 9.3 $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}$ ✓✓

(2)

Marking criteria/Nasienriglyne

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

- 9.4 % purity/suiwerheid = $\frac{m(\text{Cu})}{m(\text{Cu})_{\text{impure/onsuiwer}}} \times 100$
 $= \frac{4,4}{5} \times 100$
 $= 88\%$ ✓

(4)

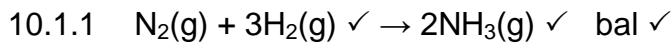
Marking criteria/Nasienriglyne:

- Substitute/Vervang 4,4 ✓
- Substitute/Vervang 5 ✓
- x 100 ✓
- Final answer/Finale antwoord: 88% ✓

[9]

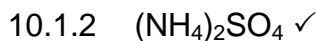
QUESTION 10/VRAAG 10

10.1

**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 \rightleftharpoons*
- Marking rule/*Nasienreël 3.9*

(3)



(1)

10.1.3 Ostwald process/*Ostwaldproses \checkmark*

(1)

10.1.4 Ammonium nitrate/*Ammoniumnitraat \checkmark*

(1)

10.2

10.2.1 The ratio of nitrogen (N), phosphorous (P) and potassium (K) in a certain fertiliser. \checkmark *Die verhouding van stikstof (N), fosfor (P) en kalium (K) in 'n sekere kunsmis.***Accept/Aanvaar :**nitrogen, phosphorous and potassium/stikstof, fosfor en kalium.

(1)

10.2.2 Percentage fertiliser in the bag./*Persentasie kunsmis in die sak. \checkmark*

(1)

10.2.3

OPTION 1/OPSIE 1:

$$\% \text{K} = \frac{5}{12} \checkmark \times 22\% \checkmark$$

$$= 9,17\%$$

$$\therefore m(\text{N}) = \frac{9,17}{100} \times 10 \text{ kg} \checkmark$$

$$= 0,92 \text{ kg} \checkmark$$

OPTION 2/OPSIE 2:

m(nutrients/voedingstowwe):

$$\frac{22}{100} \checkmark \times 10 = 2,2 \text{ kg}$$

$$\therefore m(\text{K}) = \frac{5}{12} \checkmark \downarrow (2,2) \checkmark$$

$$= 0,92 \text{ kg} \checkmark$$

(4)

[12]**TOTAL/TOTAAL:****150**