



# basic education

Department:  
Basic Education  
REPUBLIC OF SOUTH AFRICA

**NATIONAL  
SENIOR CERTIFICATE  
NASIONALE  
SENIOR SERTIFIKAAT**

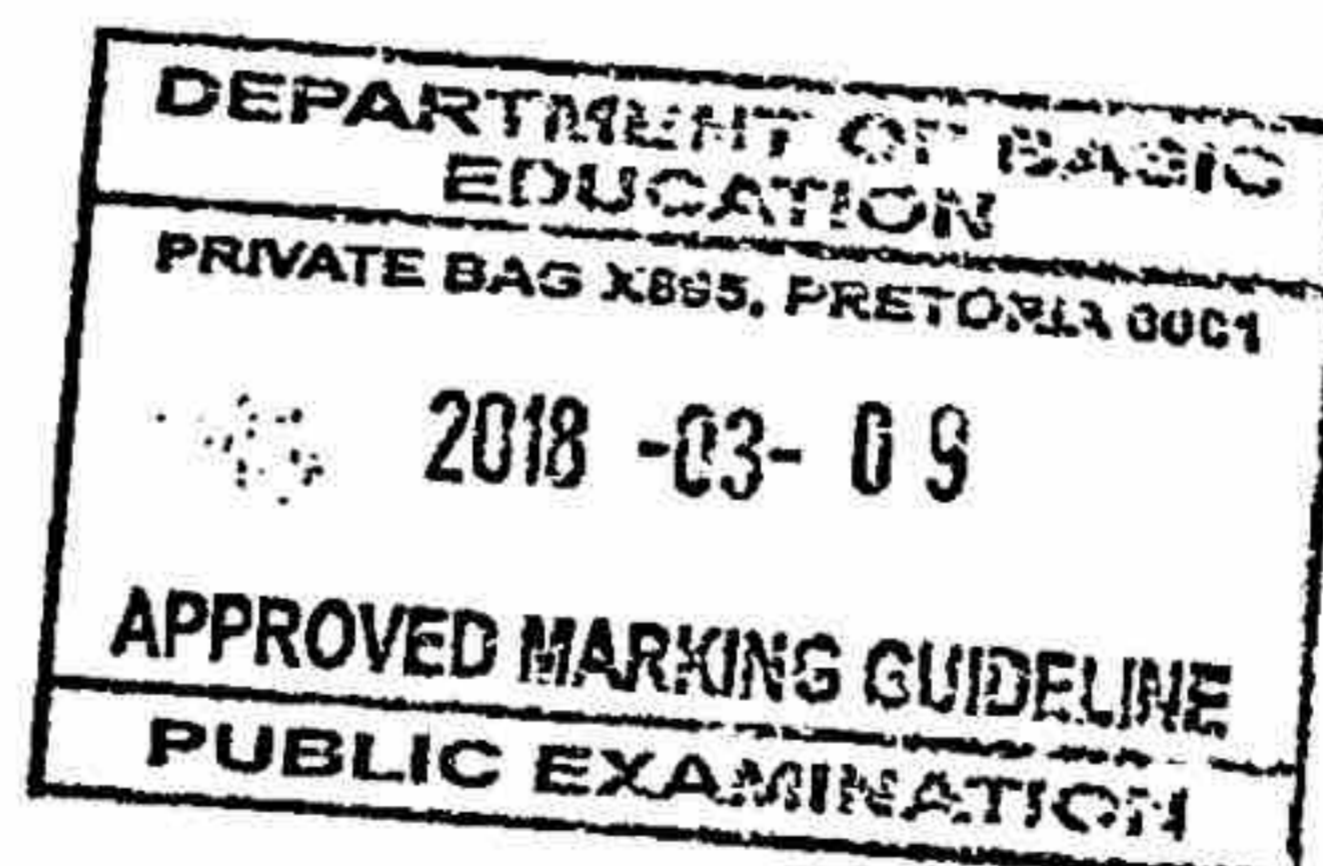
**GRADE/GRAAD 12**

**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.**

Approved: *Bajirangi*  
DBE: Int. Mod  
2018:03:09

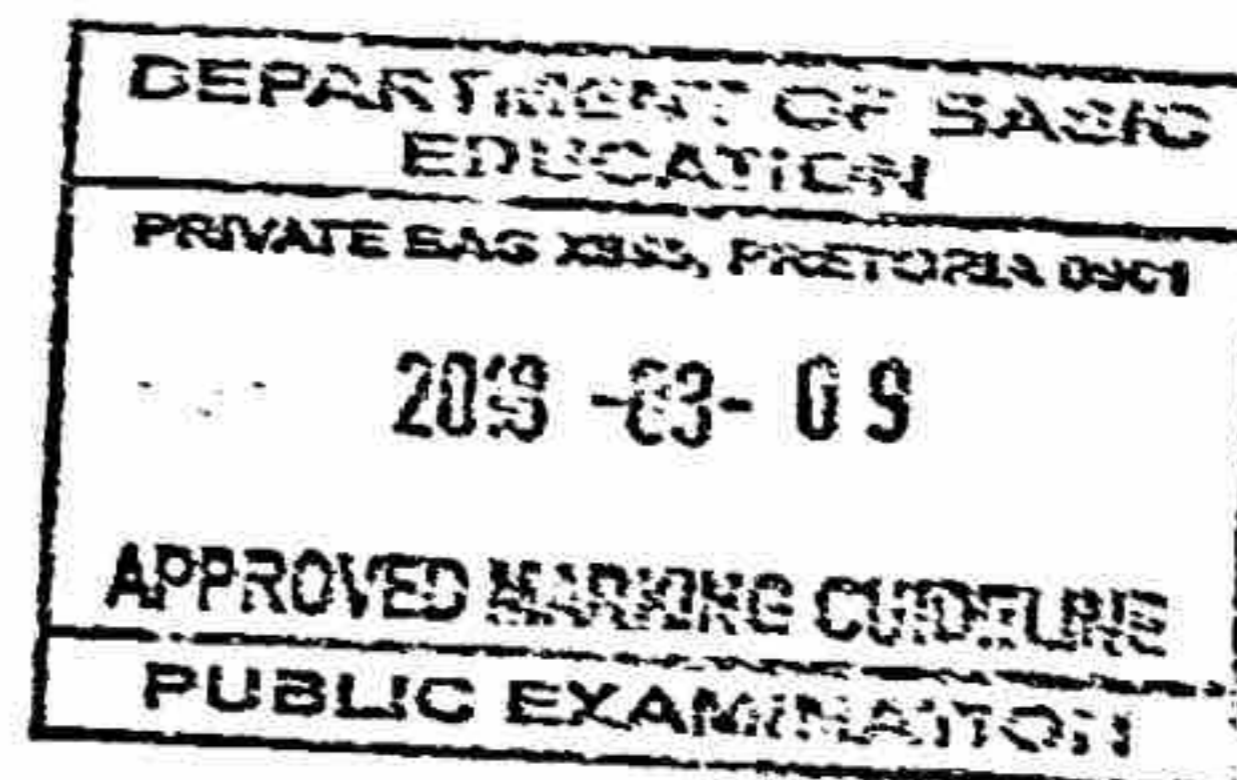
APPROVED  
*Vinyl*  
EXT. MODERATOR:  
*U. M. M. S.*

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



OR/OF

5-ethyl-6,6-dimethyl-3-octanol/5-etiesel-6,6-dimetiesel-3-oktanol

**Marking criteria/Nasiennriglyne:**

- 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:

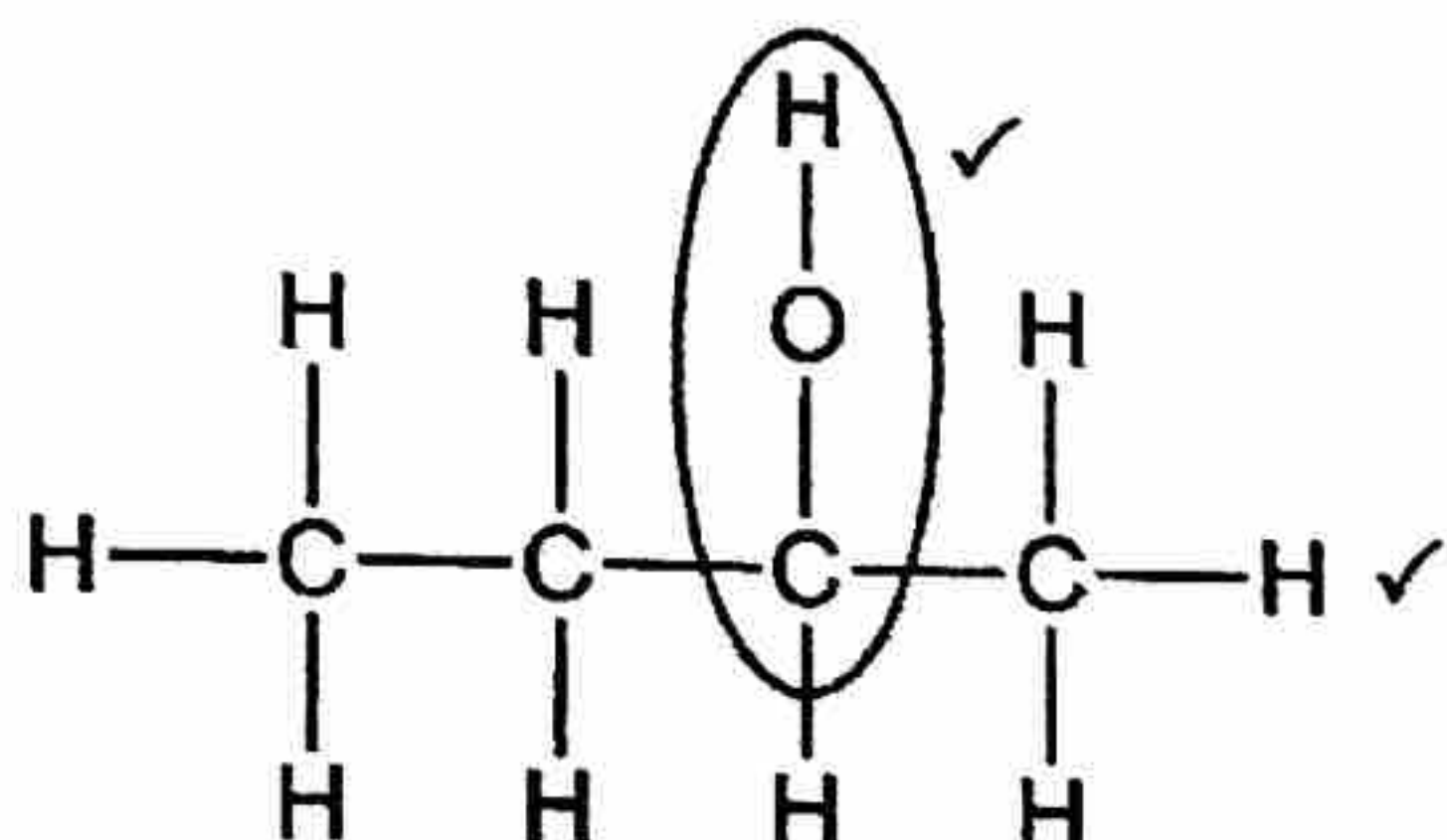
Enige fout bv. koppeltekens weggelaat en/of verkeerde volgorde: Max./Maks.  $\frac{3}{4}$

W  
(4)

8

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/Nasiemriglyne:**

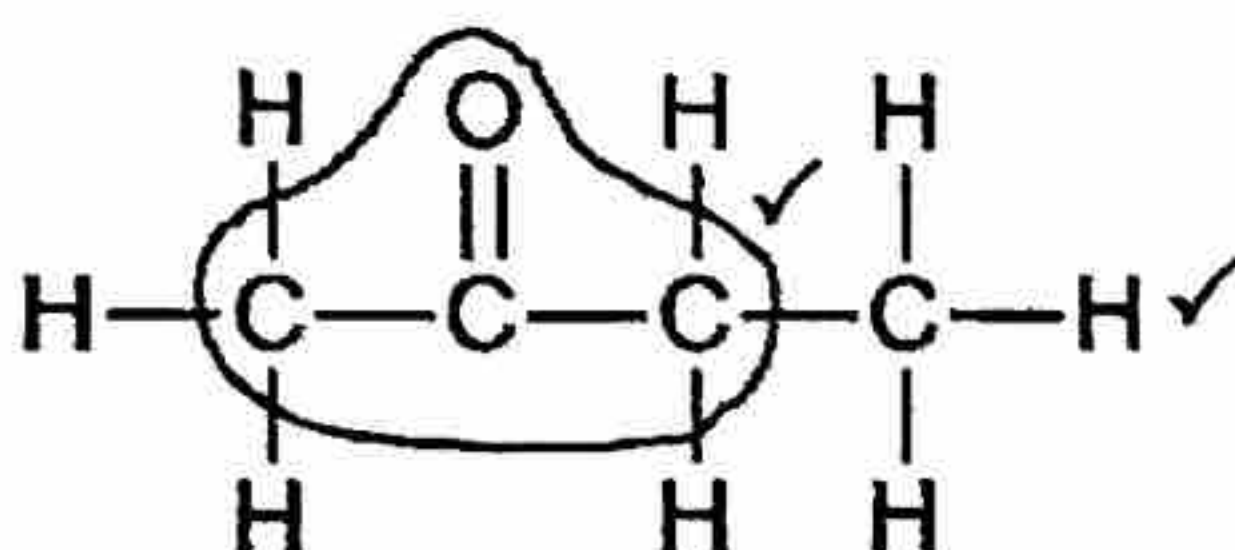
- Whole structure correct:  $\frac{2}{2}$   
*Hele struktuur korrek:*
- Only functional group correct: /Slegs funksionele groep korrek: Max/Maks.:  $\frac{1}{2}$

**IF/INDIEN:**

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

(2)

2.4.2



**Marking criteria/Nasiemriglyne:**

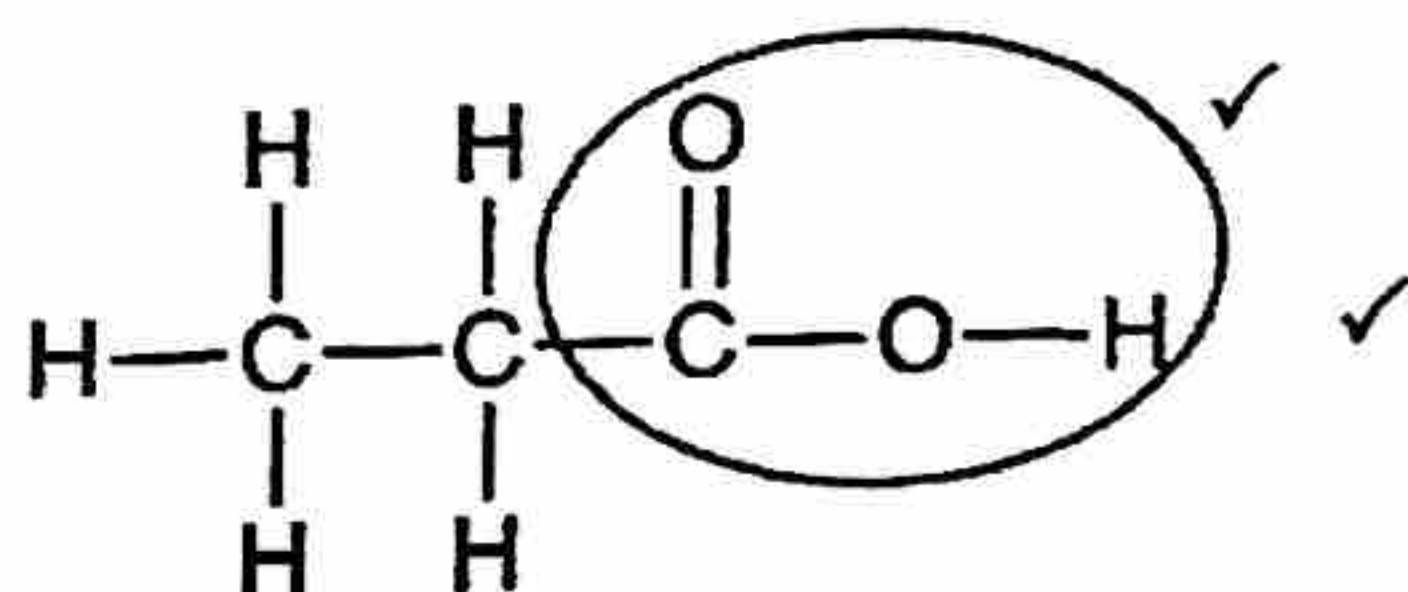
- Whole structure correct:  $\frac{2}{2}$   
*Hele struktuur korrek:*
- Only functional group correct: /Slegs funksionele groep korrek: Max/Maks.:  $\frac{1}{2}$

**IF/INDIEN:**

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

(2)

2.4.3



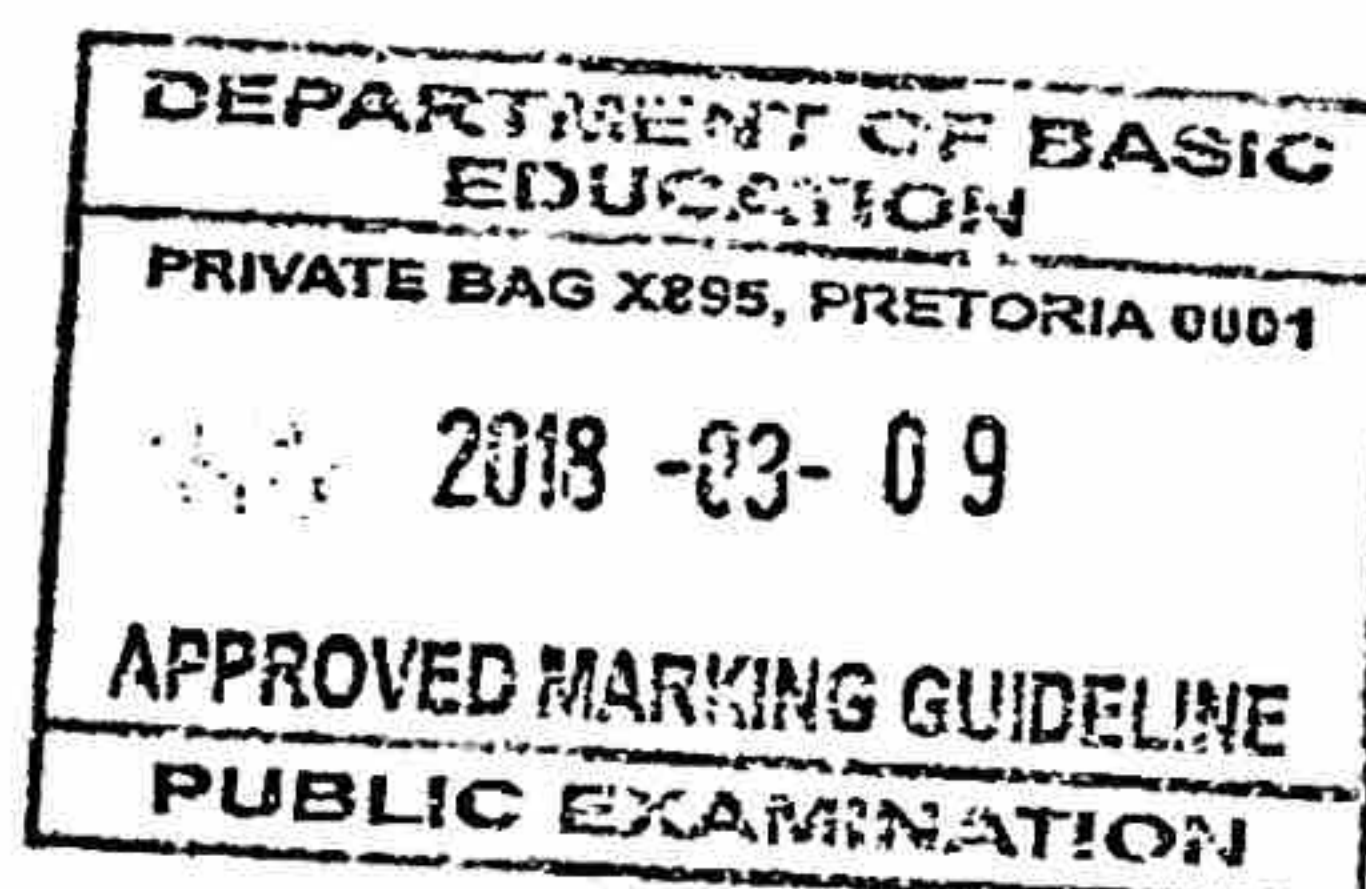
**Marking criteria/Nasiemriglyne:**

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

**IF/INDIEN:**

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

(2)  
 [17]



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**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 – 56 °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 carboxylic acid. ✓  
*Intermolekulêre kragte in karboksielsure is die sterkste./Die meeste energie word benodig om intermolekulêre kragte in karboksielsure te oorkom/breek.* (4)

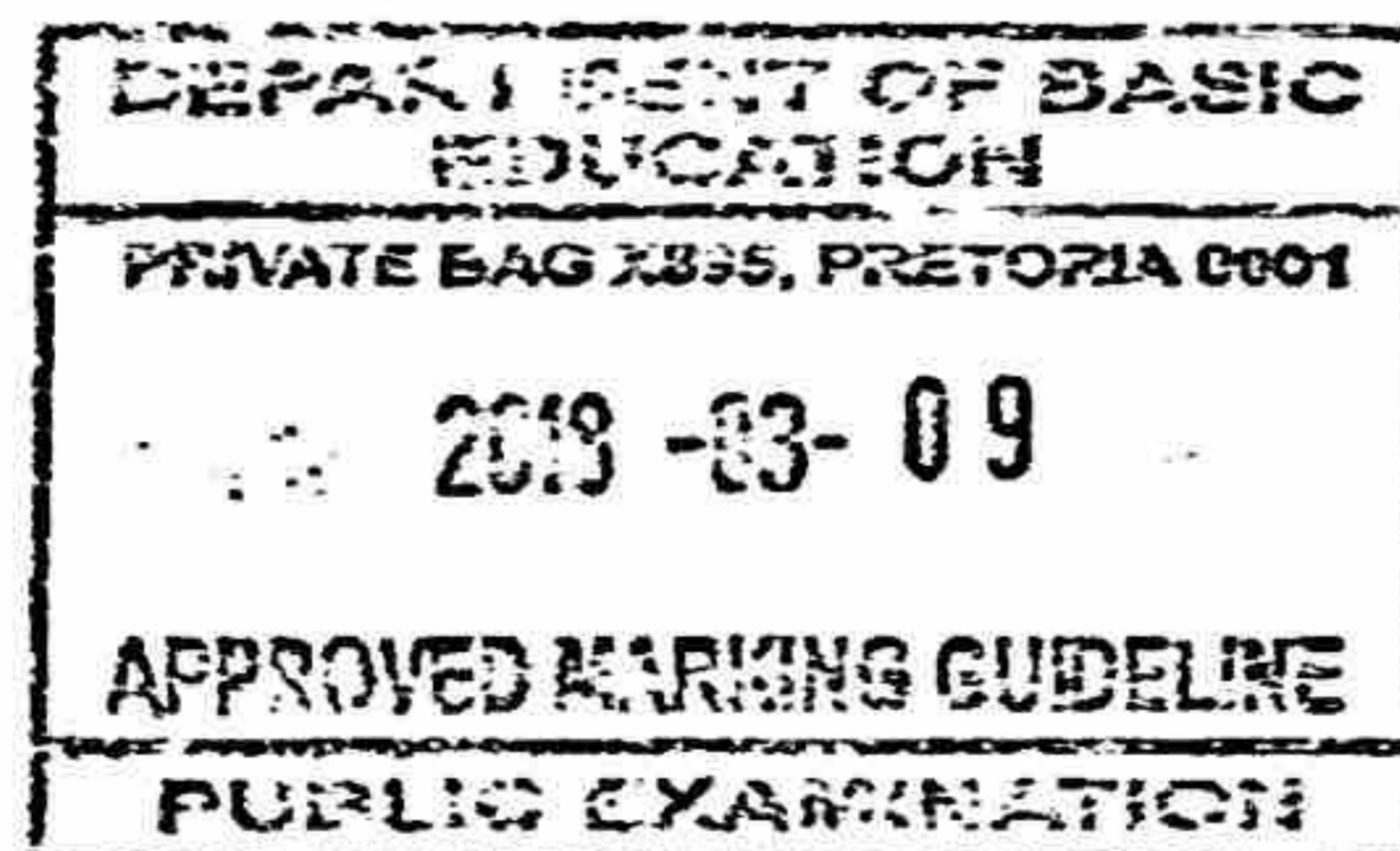
3.3.3 Propanone/Propanoon ✓

**OR/OF**

Propan-2-one/Propan-2-oon

**OR/OF**

2-propanone/2-propanoon



(1)  
[10]

*J. van*

**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)

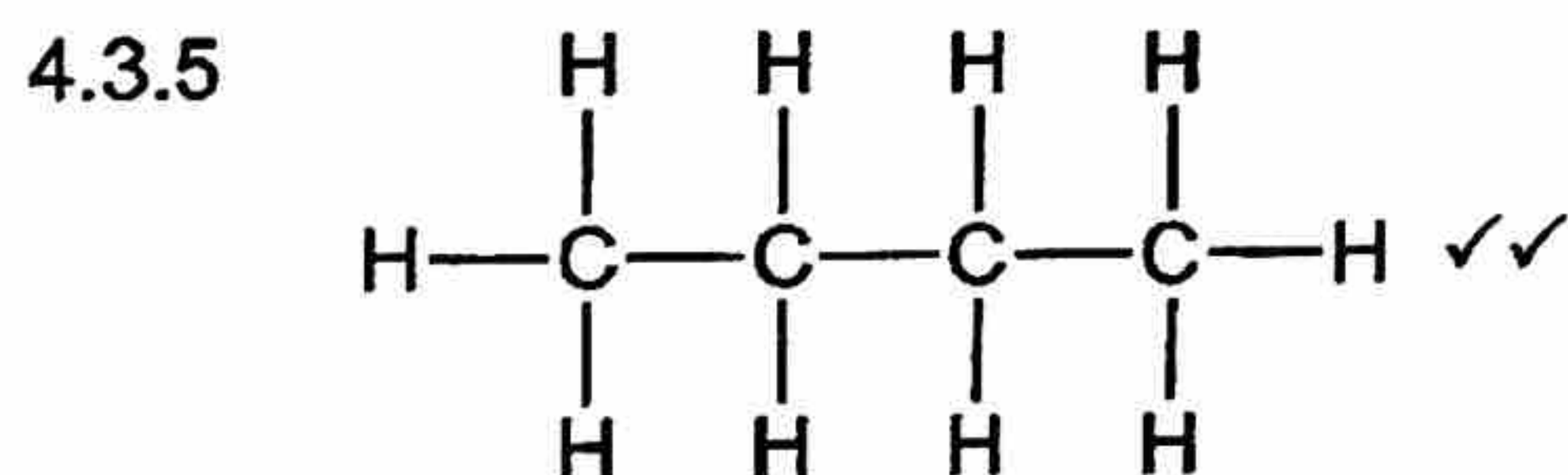
4.2.3 I ✓ (1)

4.3  
 4.3.1 Heat/Light /UV light ✓  
 Hitte/Lig/UV Lig (1)

4.3.2 P or/of S ✓ (1)

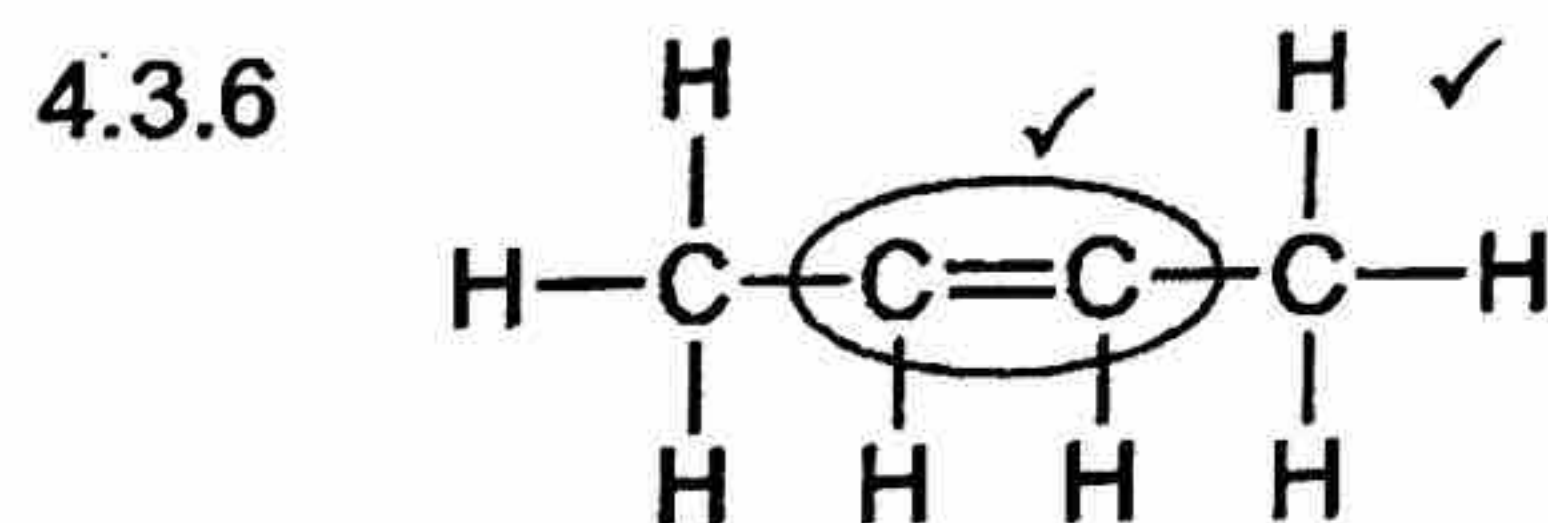
4.3.3 Ethene/Eteen ✓ (1)

4.3.4 C<sub>8</sub>H<sub>18</sub> ✓✓ (Correct Structural formula/Korrekte struktuurformule : 1/2) (2)



**Marking criteria/Nasienriglyne:**

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



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**Marking criteria/Nasienriglyne:**

- Whole structure of alkene/haloalkane correct:  
*Hele struktuur van alkeen/haloalkaan korrek:* 2/2
- Only functional group correct/Slegs funksionele groep korrek: 1/2
- Correct condensed structure/Korrekte gekondenseerde struktuur.  
 CH<sub>3</sub>CH=CHCH<sub>3</sub> 1/2

(2)  
 [14]

*S. V. V.*

## QUESTION 5/VRAAG 5

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

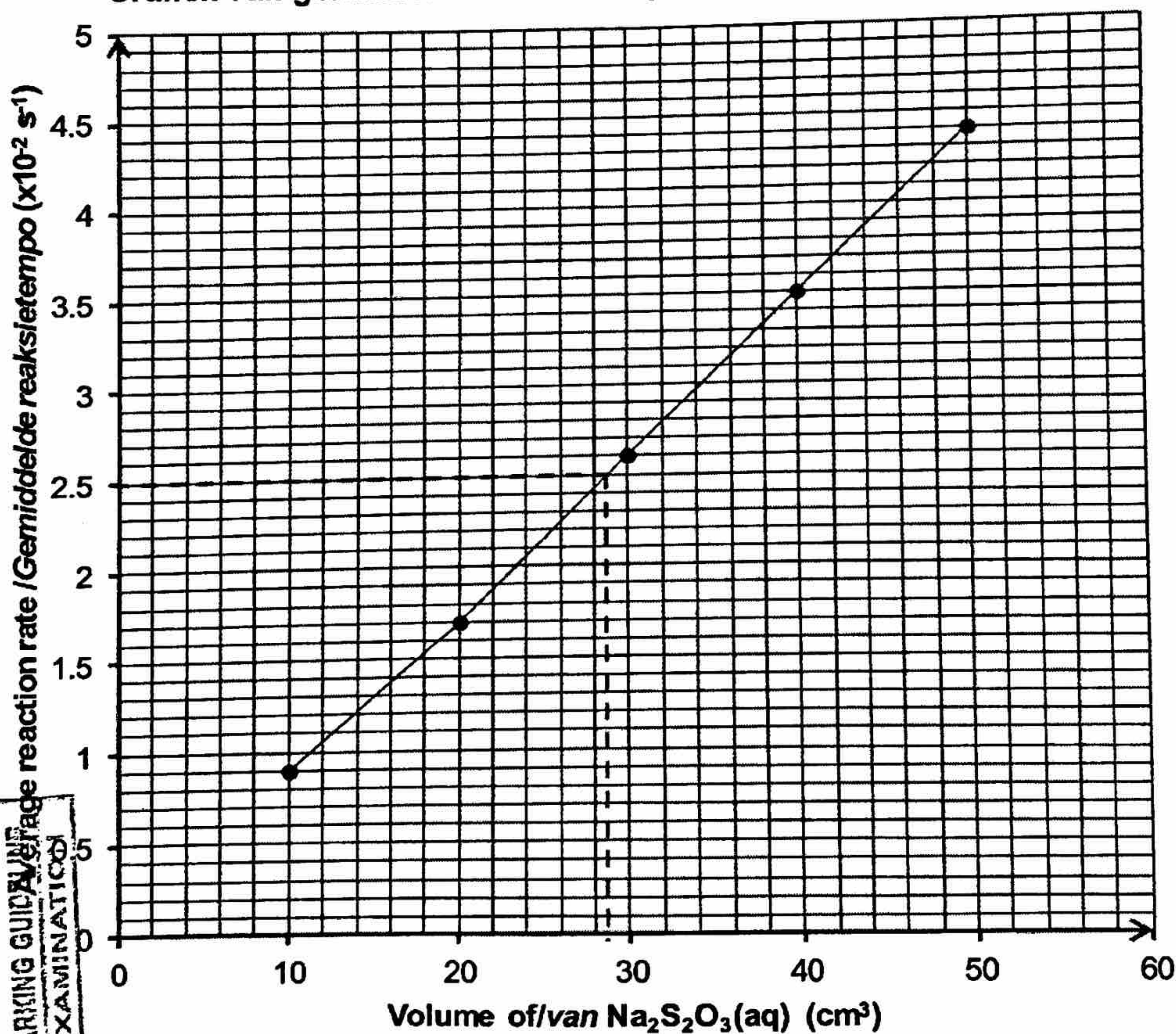
- Change in concentration ✓ of a reactant/product per unit time. ✓  
Verandering in konsentrasie van reaktanse/produkte per eenheidtyd.
- Rate of change in concentration. ✓ ✓  
Tempo van verandering in konsentrasie.
- Change in amount/number of moles/volume/mass of products/reactants per (unit) time.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

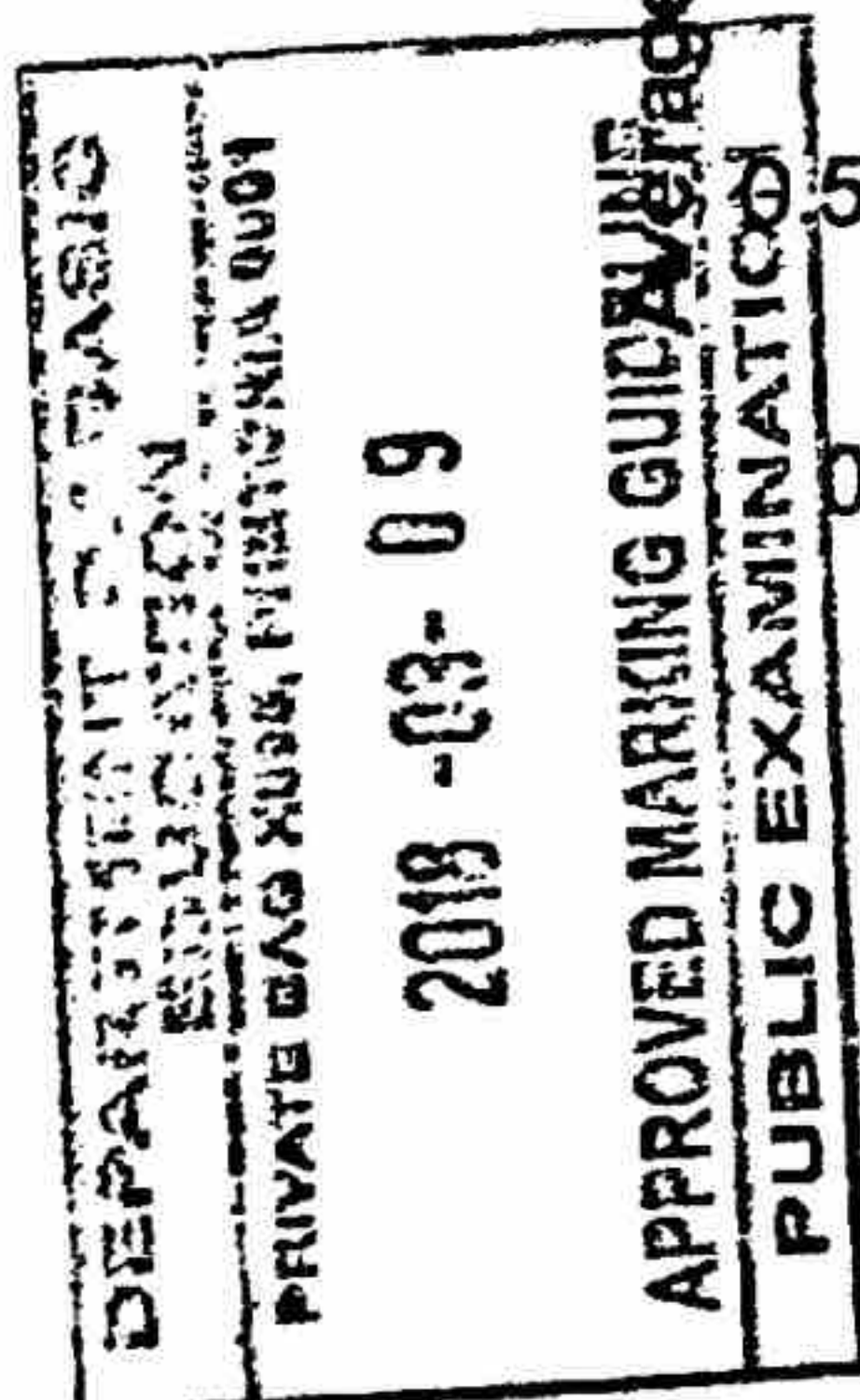
- 5.3 **Graph of average reaction rate versus volume of  $\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$**   
**Grafiek van gemiddelde reaksietempo teenoor volume  $\text{Na}_2\text{S}_2\text{O}_3(\text{aq})$**



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)

✓  
S



5.4

5.4.1

<b>Marking criteria/Nasienriglyne:</b>
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. ✓ Stippellyn getrek van y-as na x-as soos getoon.
$V = 28 \text{ to } 30 \text{ cm}^3$ ✓

(3)

5.4.2

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

**Examples/Voorbeelde:**

- Reaction rate 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

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

(4)  
[18]

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## 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. ✓✓ (2 or 0)

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)

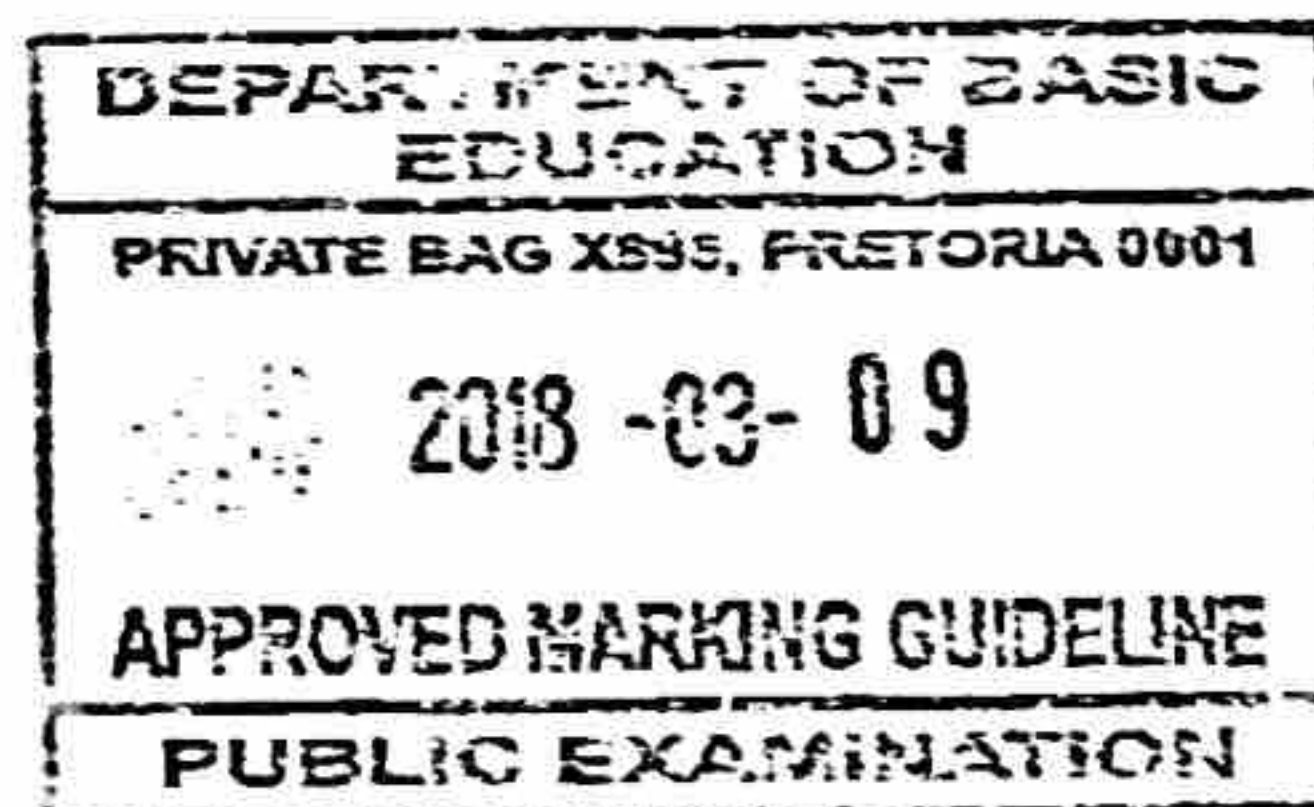
6.1.4

I ✓✓ (2)

6.2

**Mark allocation/Puntetoekenning**

- Substitution of/Vervanging van  $36,5 \text{ g mol}^{-1}$  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 ✓  
Rangel/Gebied: 13,966 to/tot 18,72



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**OPTION 1/OPSIE 1**

	HCl	O <sub>2</sub>	Cl <sub>2</sub>	H <sub>2</sub> 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 <sup>-3</sup> )	0,25	0,3625	0,375	0,375	Divide by 0,2 ✓ Deel deur 0,2

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

No K<sub>c</sub> expression, correct substitution/Geen K<sub>c</sub>-uitdrukking, korrekte vervanging:

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

Wrong K<sub>c</sub> expression/Verkeerde K<sub>c</sub>-uitdrukking: Max./Maks.  $\frac{5}{9}$

(9)

**OPTION 2/OPSIE 2:**

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

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

$$n(\text{O}_2)_{\text{reacted/reageer}} = \frac{1}{4} n(\text{HCl})_{\text{reacted/reageer}} = \frac{1}{4} \times 0,15 = 0,0375 \text{ mol}$$

$$n(\text{Cl}_2)_{\text{formed/gevorm}} = \frac{1}{2} n(\text{HCl})_{\text{reacted/reageer}} = \frac{1}{2} \times 0,15 = 0,075 \text{ mol}$$

$$n(\text{H}_2\text{O})_{\text{formed/gevorm}} = \frac{1}{2} n(\text{HCl})_{\text{reacted/reageer}} = \frac{1}{2} \times 0,15 = 0,075 \text{ mol}$$

Using ratio ✓

$$n(\text{O}_2)_{\text{equilibrium/ewewig}} = 0,11 - 0,0375 = 0,0725 \text{ mol}$$

$$n(\text{Cl}_2)_{\text{equilibrium/ewewig}} = n(\text{H}_2\text{O})_{\text{equilibrium/ewewig}} = 0,075 \text{ mol}$$

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

$$c(\text{Cl}_2)_{\text{equilibrium/ewewig}} = c(\text{H}_2\text{O})_{\text{equilibrium/ewewig}} = \frac{n}{V}$$

$$= \frac{0,075}{0,2} = 0,375 \text{ mol}\cdot\text{dm}^{-3}$$

Divide by/  
deel deur 0,2 ✓

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

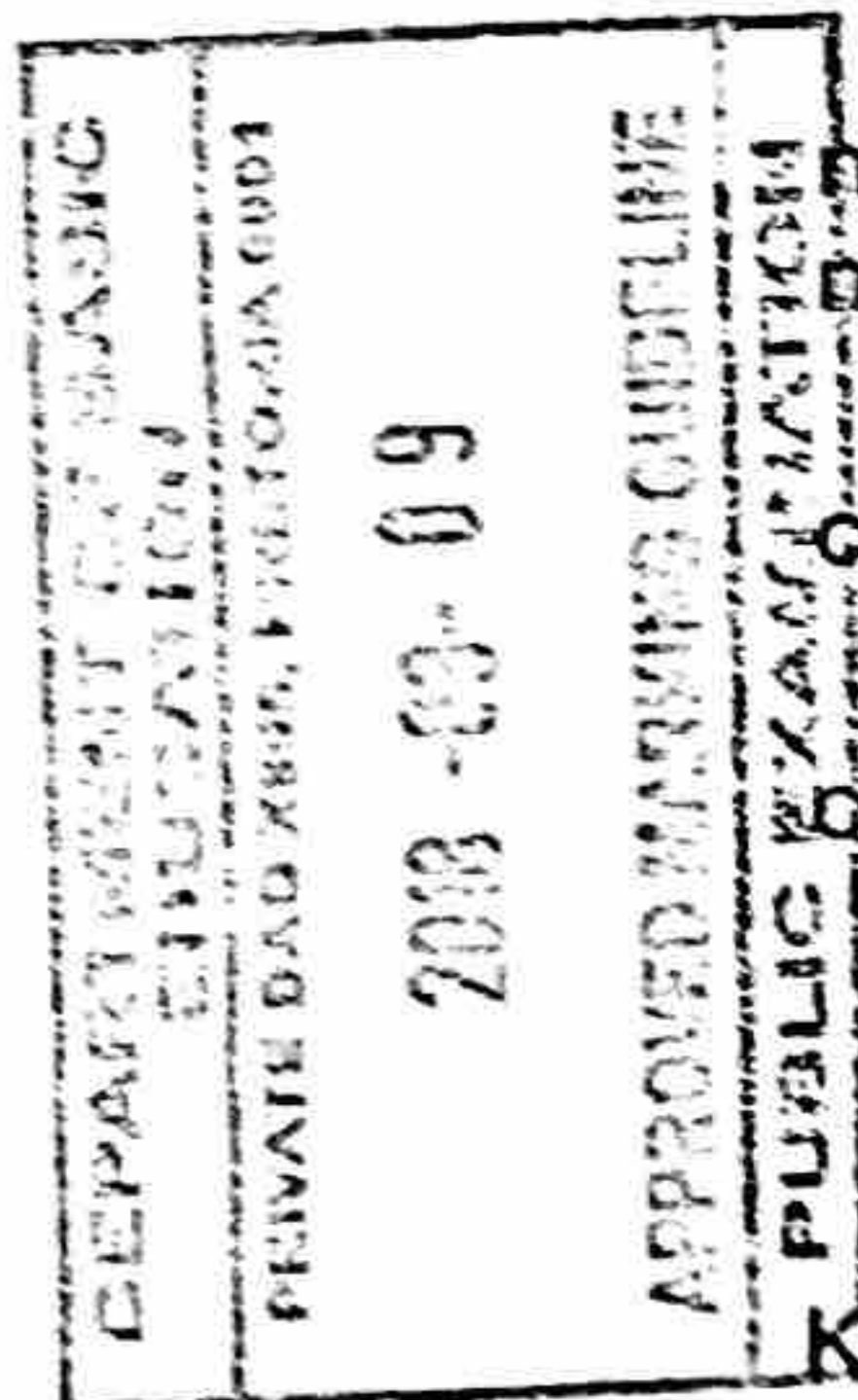
No K<sub>c</sub> expression, correct substitution/Geen K<sub>c</sub>-uitdrukking, korrekte substitusie:

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

Wrong K<sub>c</sub> expression/Verkeerde K<sub>c</sub>-uitdrukking:

Max./Maks.  $\frac{5}{9}$

(9)



**CALCULATIONS USING CONCENTRATIONS**  
**BEREKENINGE WAT KONSENTRASIES GEBRUIK**

**Mark allocation/Puntetoekenning**

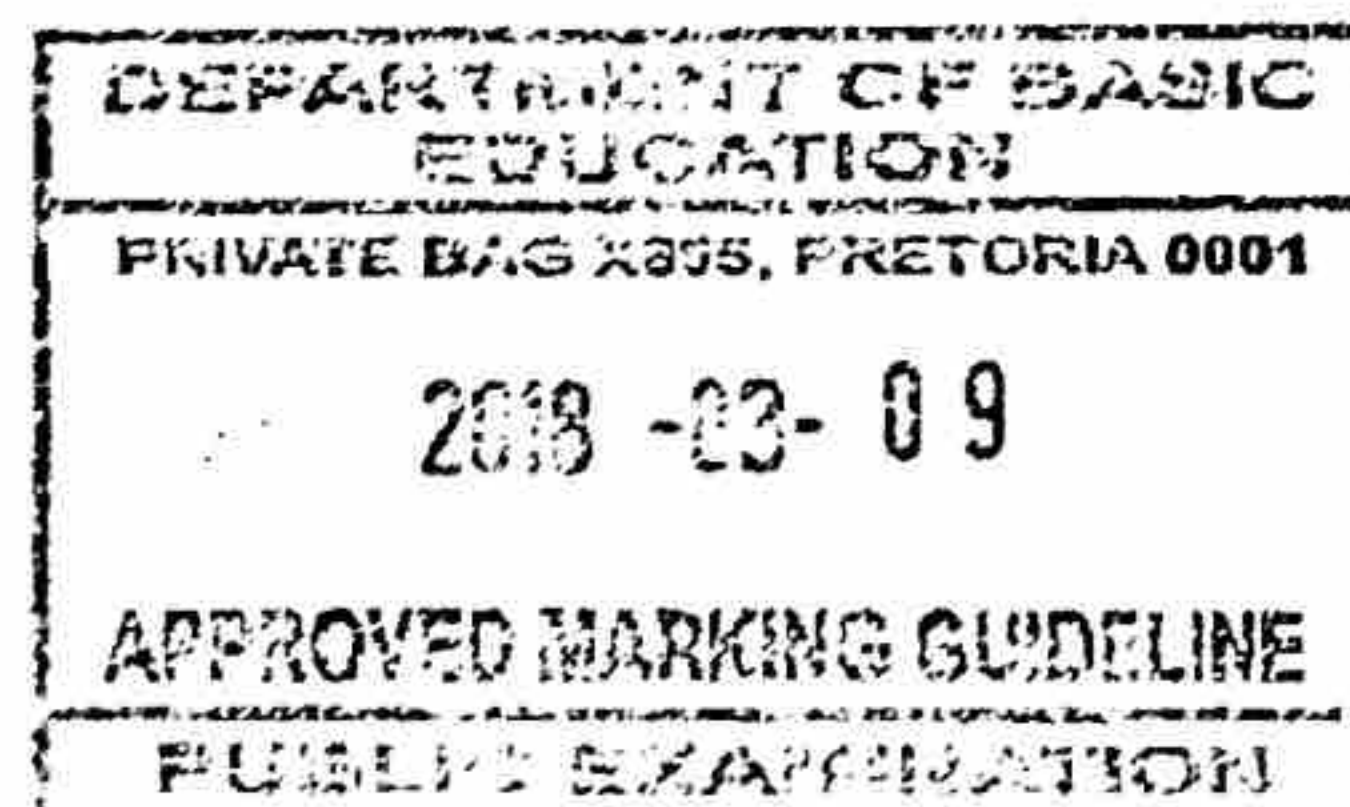
- Substitution of/Vervanging van  $36,5 \text{ g}\cdot\text{mol}^{-1} \quad n = \frac{m}{M}$ . ✓
- Initial concentration of reactants/Aanvanklike konsentrasie van reaktanse:  
 $c(\text{HCl}) = 1,0$  &  $c(\text{O}_2) = 0,55 \text{ mol}\cdot\text{dm}^{-3}$  ✓
- Change:  $c(\text{HCl}) = 0,75 \text{ mol}\cdot\text{dm}^{-3}$  (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 tot/tot 18,72

**OPTION 3/OPSIE 3**

$$n(\text{HCl})_{\text{equilibrium/ewewig}} = \frac{m}{M}$$

$$= \frac{1,825}{36,5} \checkmark$$

$$= 0,05 \text{ mol}$$



	HCl	O <sub>2</sub>	H <sub>2</sub> O	Cl <sub>2</sub>	
Initial concentration/ Aanvangskonsentrasie (mol·dm <sup>-3</sup> )	1,0 ✓	0,55	0	0	Divide by 0,2 ✓ Deel deur 0,2
Change in concentration Verandering in konsentrasie (mol·dm <sup>-3</sup> )	0,75 ✓	0,1875	0,375	0,375	ratio ✓ verhouding
Equilibrium concentration Ewewigskonsentrasie (mol·dm <sup>-3</sup> )	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.  $\frac{5}{9}$

✓ (9)  
[18]

✓

**QUESTION 7/VRAAG 7**

7.1

7.1.1 H<sub>2</sub>O ✓

HSO<sub>4</sub><sup>-</sup> ✓

(2)

7.1.2 Strong/Sterk ✓

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

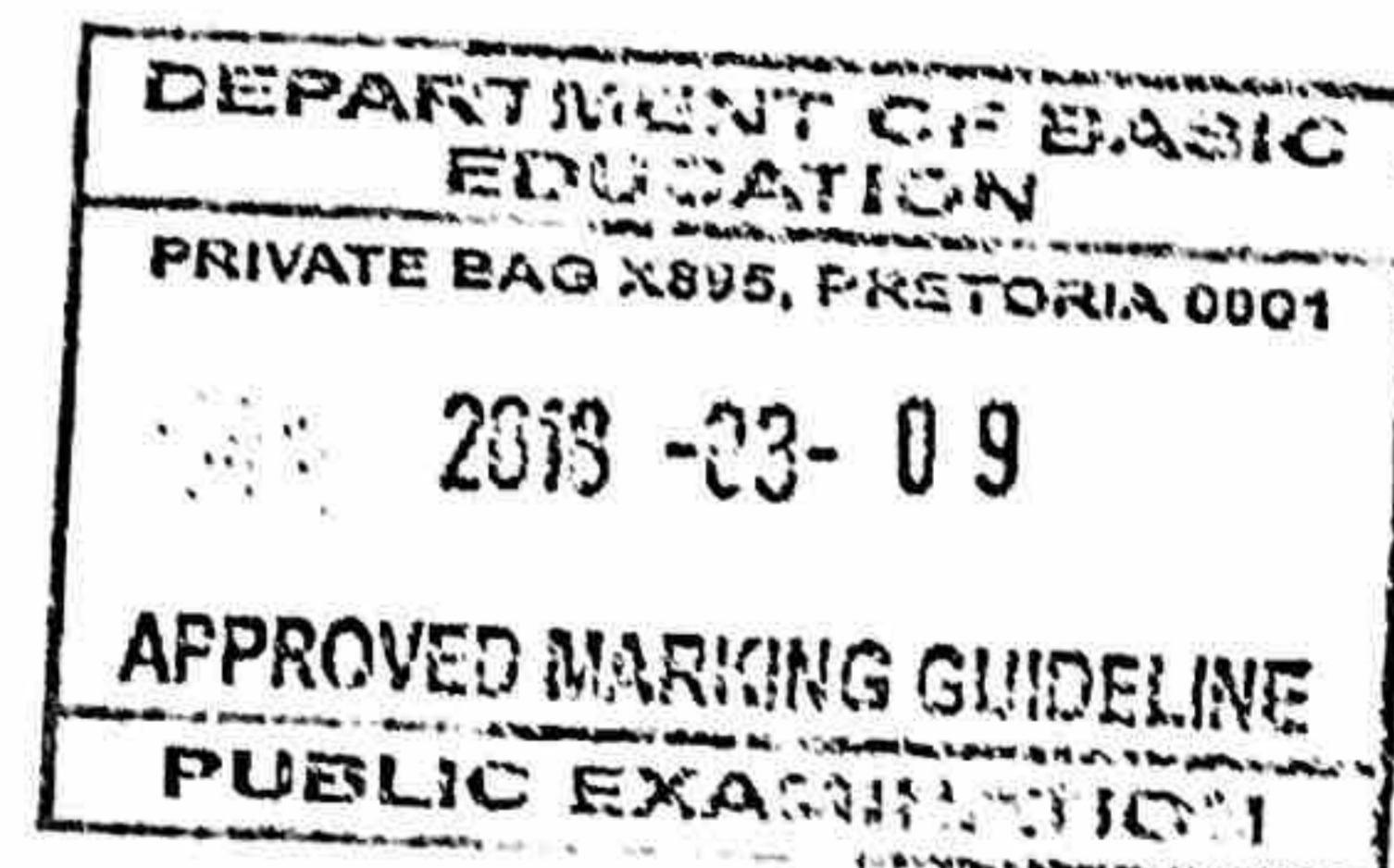
(2)

7.2

7.2.1

<b>Marking Criteria/Nasiemriglyne</b>	
<ul style="list-style-type: none"> <li>Formula/Formule: <math>\frac{c_a \times V_a}{c_b \times V_b} = \frac{n_a}{n_b} / c = \frac{n}{V}</math> ✓</li> <li>Substitute/Vervang 0,15 x 24 OR/OF 0,15 x 0,024 ✓</li> <li>Use/Gebruik 26 cm<sup>3</sup> OR/OF 0,026 dm<sup>3</sup> ✓</li> <li>Use mole ratio/Gebruik molverhouding: 1:2 ✓</li> <li>Final answer/Finale antwoord: 0,28 mol·dm<sup>-3</sup> ✓ (0.2769... mol·dm<sup>-3</sup>)</li> </ul>	
<p><b>OPTION 1/OPSIE 1</b></p> $\frac{c_a \times V_a}{c_b \times V_b} = \frac{n_a}{n_b} \checkmark$ $\frac{0,15 \times 24}{c_b \times 26} = \frac{1}{2} \checkmark$ $c(\text{NaOH}) = 0,28 \text{ mol} \cdot \text{dm}^{-3} \checkmark$	<p><b>OPTION 2/OPSIE 2</b></p> $n(\text{H}_2\text{SO}_4) = cV \checkmark$ $= (0,15)(0,024) \checkmark$ $= 3,6 \times 10^{-3} \text{ mol}$ $n(\text{NaOH}) = 2(3,6 \times 10^{-3}) \checkmark$ $= 7,2 \times 10^{-3} \text{ mol}$ $c = \frac{n}{V}$ $= \frac{7,2 \times 10^{-3}}{0,026} \checkmark$ $= 0,28 \text{ mol} \cdot \text{dm}^{-3} \checkmark$

(5)



*Handwritten initials/signature*

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**

$$n(\text{NaOH}) = cV$$

$$= 0,02 \times 0,28 \checkmark$$

$$= 0,0056 \text{ mol}$$

$$n(\text{H}_2\text{SO}_4) = 0,03 \times 0,15 \checkmark$$

$$= 0,0045 \text{ mol}$$

$$n(\text{H}_2\text{SO}_4)_{\text{used}} = \frac{1}{2}n(\text{NaOH}) \checkmark$$

$$= 0,0028$$

$$n(\text{H}_2\text{SO}_4)_{\text{excess}} = 0,0045 - 0,0028 \checkmark$$

$$= 0,0017 \text{ mol}$$

$$[\text{H}_2\text{SO}_4] = \frac{n}{V} = \frac{0,0017}{0,05} \checkmark$$

$$= 0,034 \text{ mol} \cdot \text{dm}^{-3}$$

$$[\text{H}_3\text{O}^+] = 2[\text{H}_2\text{SO}_4] \checkmark$$

$$= 2 \times 0,034 \checkmark$$

$$= 0,068 \text{ mol} \cdot \text{dm}^{-3}$$

$$\text{pH} = -\log[\text{H}_3\text{O}^+] \text{ OR/OF } -\log(0,068) \checkmark$$

$$= 1,17 \checkmark \quad (1,167)$$

**OPTION 2/OPTION 2**

$$n(\text{NaOH}) = cV$$

$$= 0,02 \times 0,28 \checkmark$$

$$= 0,0056 \text{ mol}$$

$$n(\text{H}_2\text{SO}_4) = 0,03 \times 0,15 \checkmark$$

$$= 0,0045 \text{ mol}$$

$$n(\text{H}_3\text{O}^+) = 2n(\text{H}_2\text{SO}_4) \checkmark$$

$$= 2 \times 0,0045$$

$$= 0,009 \text{ mol}$$

$$n(\text{H}_3\text{O}^+)_{\text{excess}} = 0,009 - 0,0045 \checkmark$$

$$= 0,0034 \text{ mol}$$

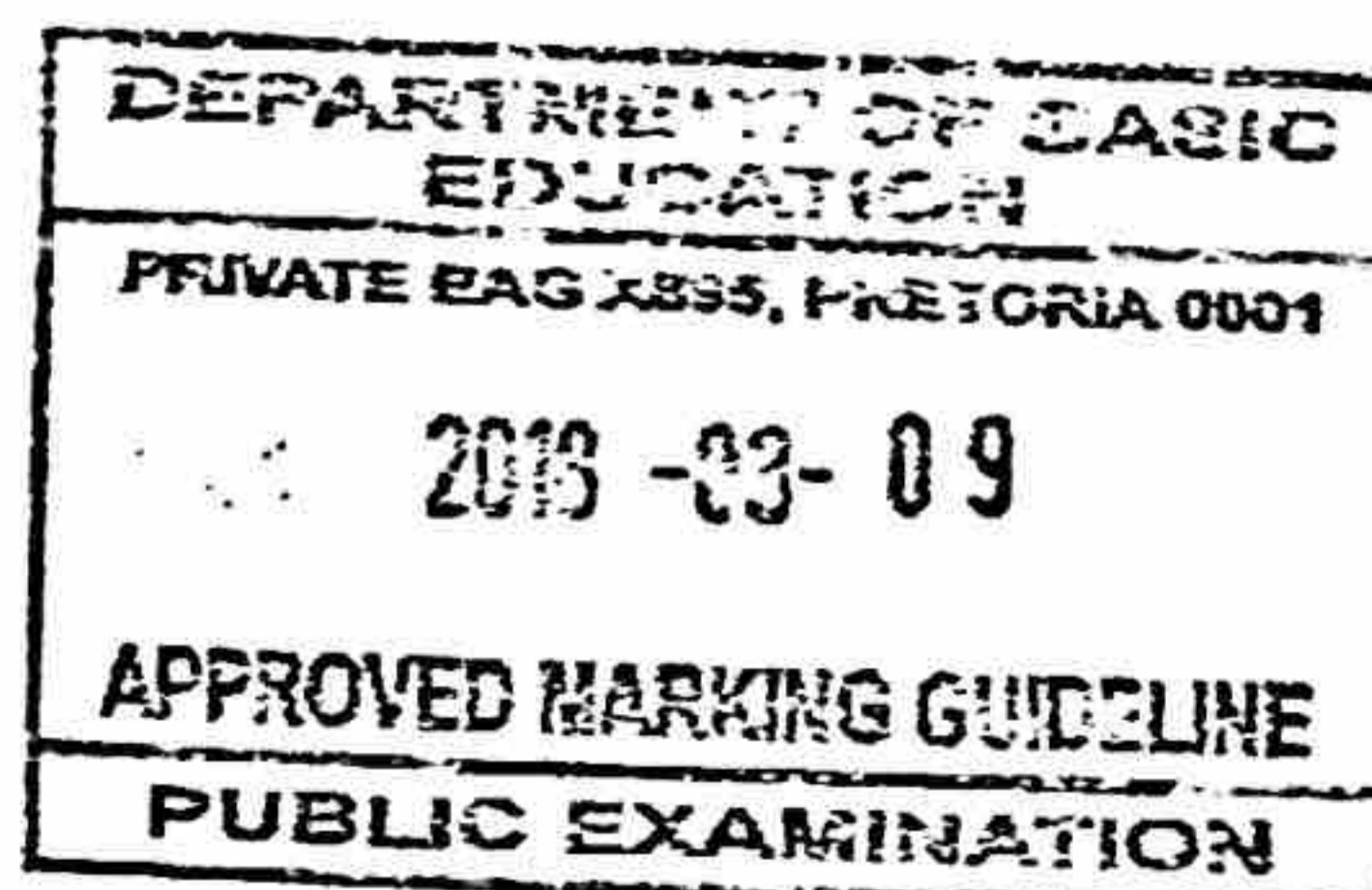
$$c(\text{H}_3\text{O}^+) = \frac{n}{V} \checkmark$$

$$= \frac{0,0034}{0,05} \checkmark$$

$$= 0,068 \text{ mol} \cdot \text{dm}^{-3}$$

$$\text{pH} = -\log[\text{H}_3\text{O}^+] \text{ OR/OF } -\log(0,068) \checkmark$$

$$= 1,17 \checkmark \quad (1,167)$$

(8)  
[17]

**QUESTION 8/VRAAG 8**

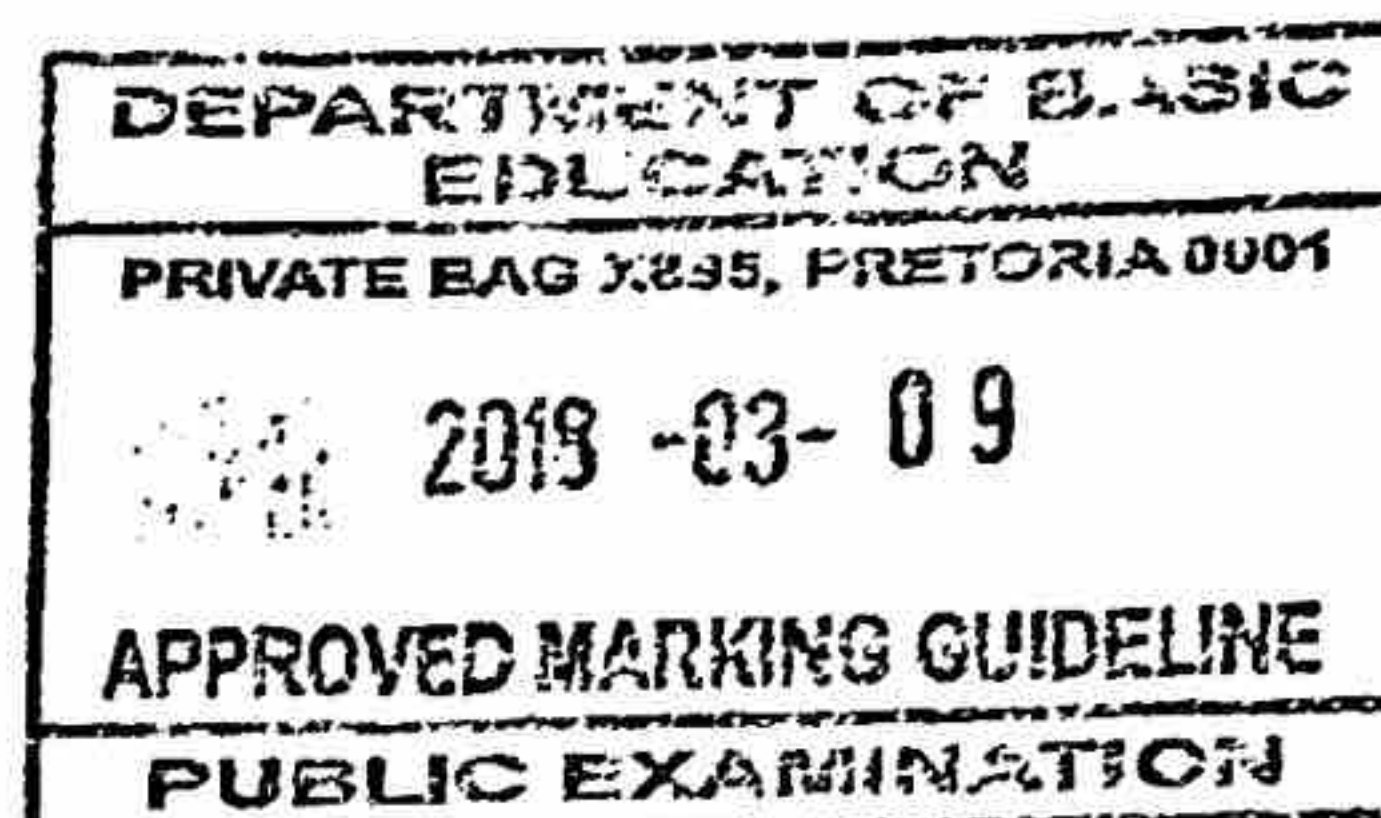
8.1

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

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

**OR/OF**

Mg is a stronger reducing agent ✓ (than Cu) and will reduce  $\text{Cu}^{2+}$  to Cu.  
*Mg is 'n sterker reduseermiddel (as Cu) en sal  $\text{Cu}^{2+}$  na Cu reduseer.* (3)

[15]

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## QUESTION 9/VRAAG 9

- 9.1 The chemical process in which electrical energy is converted to chemical energy. ✓✓ (2 or 0)  
 '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/Nasiennriglyne

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

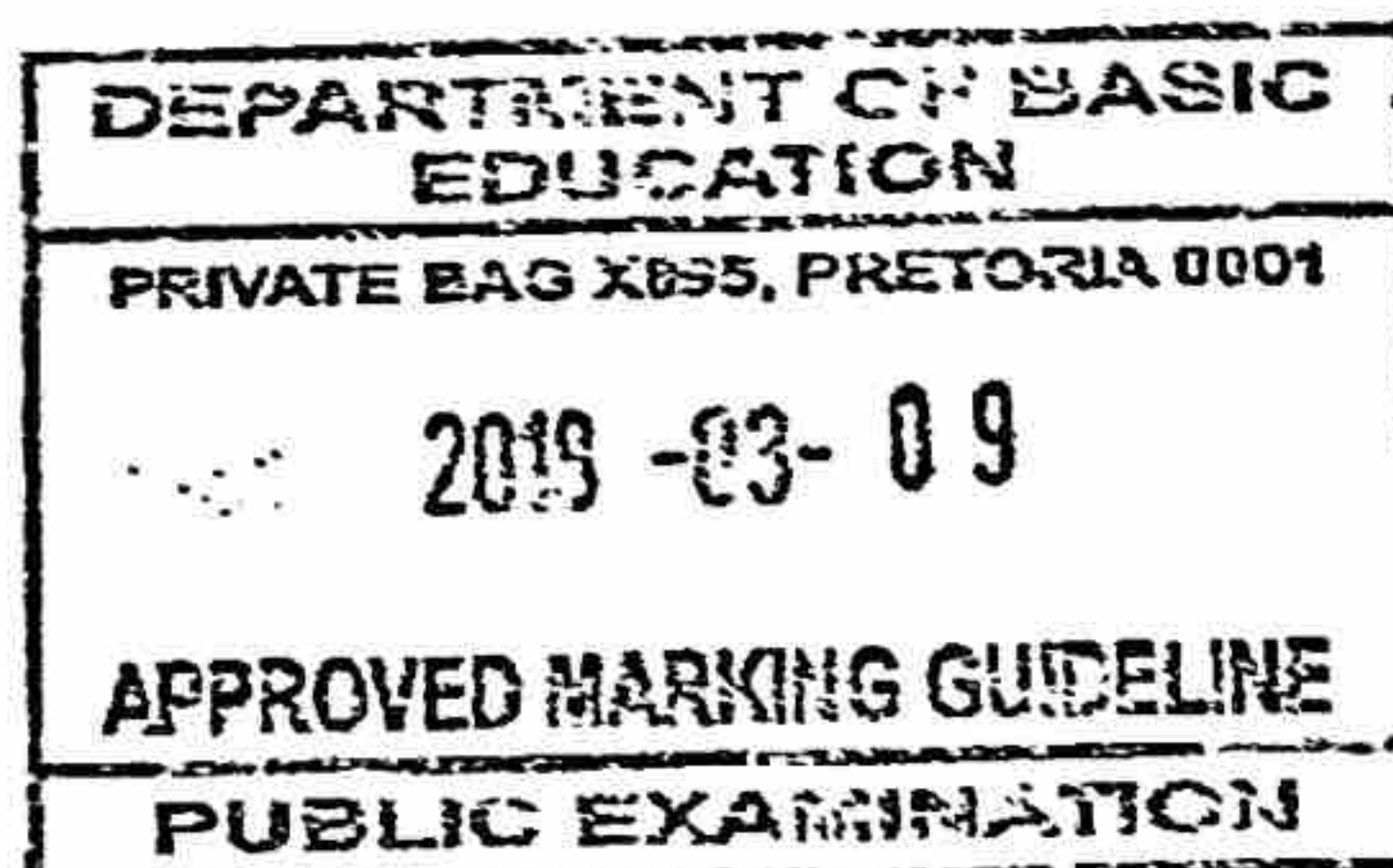
- 9.4 % purity/suiwerheid =  $\frac{m(\text{Cu})}{m(\text{Cu})_{\text{impure/on suiwer}}} \times 100$   
 $= \frac{4,4}{5} \times 100$  ✓  
 $= 88\%$  ✓

(4)

Marking criteria/Nasiennriglyne:

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

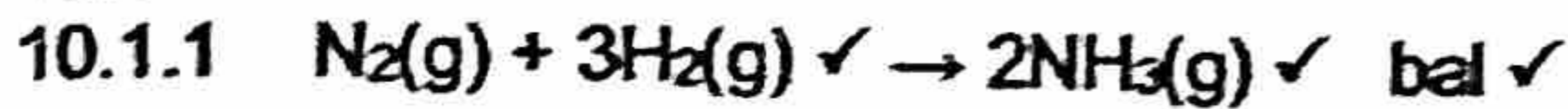
[9]



Verf.  
 S

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  $\Rightarrow$
- Marking rule/Nasiennreël 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:

$$\begin{aligned} \% K &= \frac{5}{12} \checkmark \times 22\% \checkmark \\ &= 9,17\% \\ \therefore m(K) &= \frac{9,17}{100} \times 10 \text{ kg} \checkmark \\ &= 0,92 \text{ kg} \checkmark \end{aligned}$$

OPTION 2/OPSIE 2:

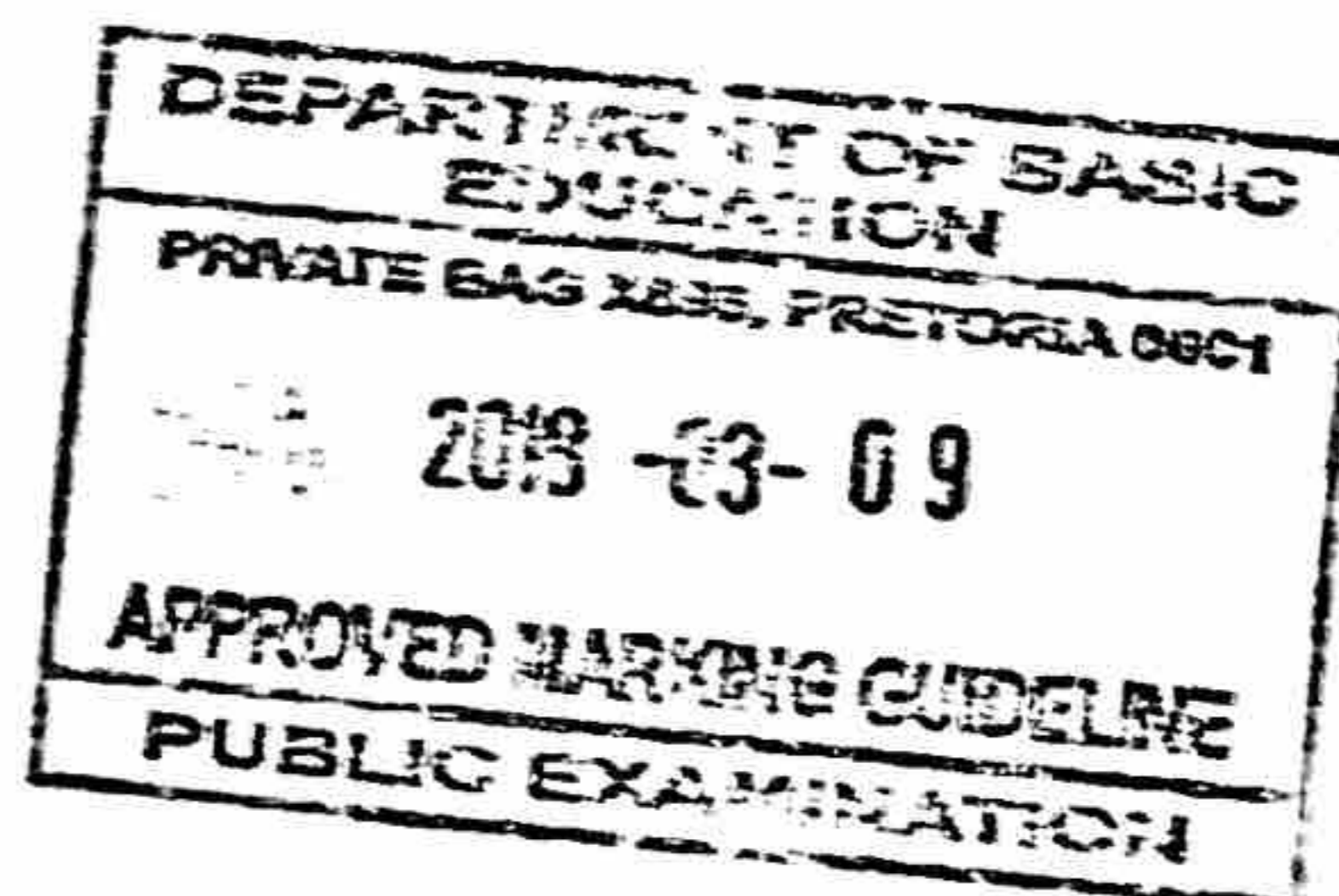
m(nutrients/voedingstowwe):

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

$$\begin{aligned} \therefore m(K) &= \frac{5}{12} \checkmark (2,2) \checkmark \\ &= 0,92 \text{ kg} \checkmark \end{aligned}$$

(4)  
[12]

TOTAL/TOTAAL: 150



Verf.  
S.