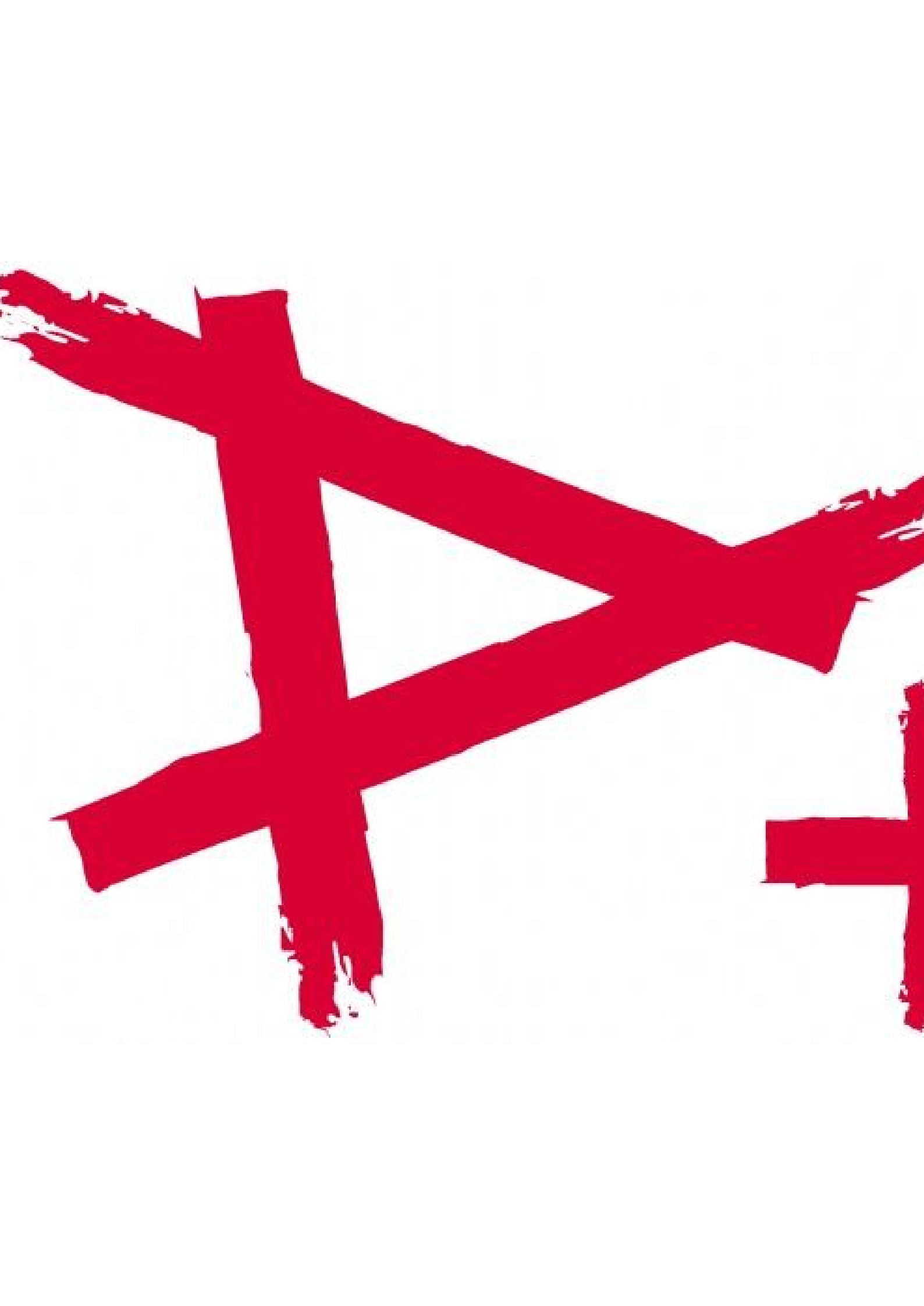






LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

**NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

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

**SEPTEMBER 2019
MEMORANDUM**

MARKS/PUNTE: 150

*This memorandum consists of 9 pages.
Hierdie memorandum bestaan uit 9 bladsye.*

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QUESTION 1/VRAAG 1

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

[20]**QUESTION 2/VRAAG 2**

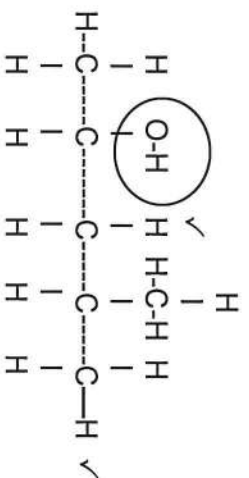
- 2.1. 1 2,3-dimethyl ✓ pent-2-ene ✓ /
2,3-dimethyl pent-2-ene ✓
OR/OF
2,3- dimethyl -2-pentene /
2,3- dimethyl-2-pentene ✓

Mark allocation/ punte toekenning
pentene ✓
Rest correct ✓ / res korrek

 (2)

- 2.1.2 3-bromo-4-methyl ✓ heksane ✓ / 3-bromo-4-methylheksaan (2)

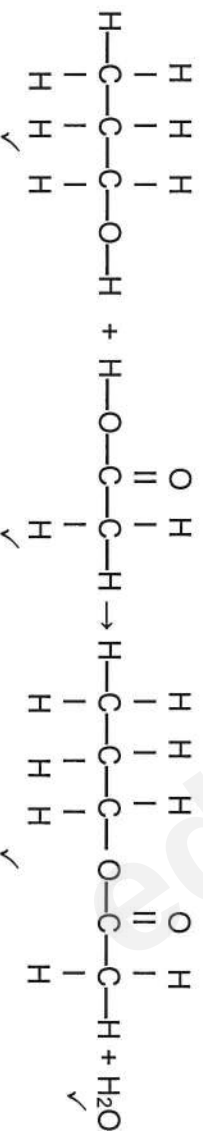
2.2



Mark allocation/ punte toekenning
OH ✓ (functional group)/funksionele group
Rest correct ✓ / res korrek

(2)

2.3

(4)
[10]

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QUESTION 3/RAAG 3

- 3.1 The temperature✓ at which vapour pressure equals atmospheric pressure✓ (2)
Die temperatuur waar die dampdruk gelyk is aan die atmosferiese druk.
- 3.2 A ✓ (1)
- 3.3 Butane✓ /Butaan (2)
- 3.4.1 Organic molecules with the same molecular formula, ✓ but different structural formulae✓ (2)
Organiese molekules met dieselfde molekulêre formule maar verskillende struktuurformule.
- 3.4.2 Chain isomers✓ /kettingisomere✓ (1)
- 3.4.3 B/Pentane is a straight chain molecule and C/2-methylbutane is branched. ✓ (1)
OR
B/ Pentane has a larger surface area than C/ 2-methylbutane./ pentane molecules can move closer together.
• The intermolecular forces/ attractive forces between B/ pentane molecules are stronger✓ than those between C/2-methylbutane molecules.
• More energy is needed to overcome the intermolecular forces **between** the B/ pentane molecule.✓ (DO NOT ACCEPT: break bonds!!!)
- B/Pentane is 'n reguit ketting en C/2-metielbutaan is vertak.
OF
B/Pentaan het 'n groter reaksieoppervlakte as C/ 2-metielbutaan./ pentaan molekule kan nader aan mekaar beweeg.
• Die aantrekkingskragte /intermolekulêre kragte tussen B/pentaanmolekule is sterker as tussen C/2-metielbutaan molekule.
• Meer energie word vereis om die intermolekulêre kragte tussen die B/pentaanmolekule te oorkom. (3)
- 3.5
- B/Pentane has London forces (between molecules),
D/pentan-1-ol has hydrogen bonding forces
• More energy is needed to overcome the intermolecular forces **between** D/pentan-1-ol (than with B/ pentane molecule) /OR less energy needed to overcome the intermolecular forces **between** B/ pentane molecule than between D/pentan-1-ol
- B/Pentaan besit Londonkragte (tussen die molekule) en D/pentan-1-ol waterstofbindings tussen die molekule.
• Waterstofbindings is sterker as Londonkragte
• Meer energie is nodig om die intermolekulêre kragte by D/pentan-1-ol te oorkom as by B/pentaan (4)
[15]

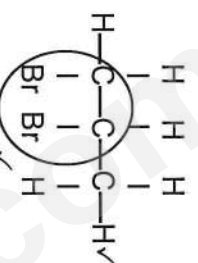
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QUESTION 4/VRAAG 4

4.1.1 Prop-1-ene has a double bond✓/ does not only have single bonds / can undergo addition and bond with another 2 hydrogen atoms/ each C-atom is not bonded to another 4 atoms.

Prop-1-ene bevat nie slegs enkelbindings nie / bevat 'n dubbelbinding tussen twee koolstofatome / kan addisie ondergaan en met nog 'n waterstof verbind/ elke C-atoom nie met 4 ander atome verbind nie. (1)

4.1.2 a Addition ✓/Addisie ✓ (1) b Substitution✓ /Substitusie ✓ (1)



Functional group correct✓/
Funksionele groep korrek ✓
Whole molecule correct✓/
Molekuul korrek ✓

(2)

4.1.4 Heat/ sunlight / ultra violet light ✓
Hitte / sonlig / ultravioleëlig (1)

4.1.5 Butane✓ /Butaan ✓ (1)

4.1.6 Hydrogen bromide or/of HBr ✓Waterstofbromied / (1)

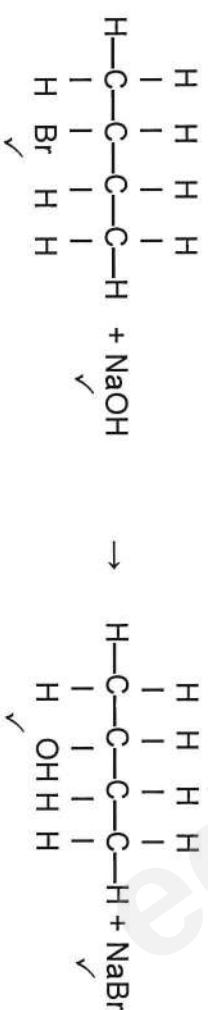
4.1.7 Reaction I ✓
Prop-1-ene is unsaturated ✓ en butane (X) is saturated✓
Reaction I is an addition reaction✓, reaction II a substitution reaction.✓
(addition takes place faster than substitution)./
Reaction I needs less energy✓ than reaction II✓
Any one of the above explanations.

Reaksie I (sal die broom vinniger ontkleur)
Prop-1-ene is onversadig en butaan (X) is versadig
By reaksie I vind 'n addisie reaksie plaas en by reaksie II substitusie.
Addisie vind vinniger plaas as substitusie./
By reaksie I is minder (aktiverings)energie nodig as by reaksie II om die reaksie te laat plaasvind./
Enige een van bogenoemde verduidelikings.

(3)

4.2.1 Elimination ✓/Eliminasie ✓ (1)

4.2.2 But-2-ene✓ / 2-ene✓ / 2-butene✓ / But-2-ene✓ / 2-buteen ✓ (2)



(4)

4.2.4 Hidrolisis ✓/ Hidrolise

(1)
[19]

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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 reaktantse/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/reaktante 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 reaktante gebruik per (eenheid)tyd
- 5.2 $\text{CaCO}_3 + 2\text{HCl} \checkmark \rightarrow \text{CaCl}_2 + \text{CO}_2 + \text{H}_2\text{O} \checkmark$ (bal ✓) (3)
- 5.3 0,4 g ✓ (1)
- 5.4 2-4 minutes ✓ /minute Gradient is higher/steeper ✓ /Gradient is steeper/hoër (2)
- 5.5 3,8 minutes ✓ /minute (1)
- 5.6.1 Increases ✓ / Neem toe (1)
- 5.6.2 Remains the same ✓ / Bly dieselfde (1)
- 5.7 R ✓ (1)
- 5.8.1 Exothermic ✓ /Eksotermies (1)
- 5.8.2 Remains the same ✓ /Bly dieselfde (1)
- 5.8.3 Activation energy ✓ (E_A) decreases ✓
 Aktiveringsenergie verlaag (2)
- [16]

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QUESTION 6/VRAAG 6

- 6.1 Closed system ✓/reversible reaction ✓/ Geslote sisteem, omkeerbare reaksie (2)

- 6.2 $X_2A_2(g) + A_2(g) \rightarrow 2XA_2(g)$ ✓ (Note: if $\rightleftharpoons$ (double arrows), 0 /indien $\rightleftharpoons$ (dubbel pyltjies), 0 (1)

- 6.3.1 Increases ✓/Neem toe ✓ (1)

- 6.3.2 Remains the same ✓ /Bly dieselfde ✓ (1)

- 6.4.1 Decreases ✓/Neem af ✓ (1)

- 6.4.2  Exothermic ✓ / Eksotermies.

- The forward reaction is favoured ✓ and according to Le Chatelier a decrease in temperature favours the exothermic reaction ✓
Die voorwaartse reaksie word bevoordeel ✓ en volgens Le Chatelier sal 'n verlagings in temperatuur ✓ die eksotermiese reaksie bevoordeel
- The rate of the reverse reaction decreases more ✓ than the rate of the forward reaction. ✓ / die tempo van die terugwaartse reaksie neem meer af ✓ as die tempo van die terugwaartse reaksie ✓ (3)

6.4.3 POSITIVE MARKING FROM QUESTION 6.4.2/POSITIEWE NASIEN VANAF VRAAG 6.4.2

- Increases ✓ /Neem toe ✓ (1)
(If endothermic for 6.4.2 only mark decreases correct here)

6.5 Mark allocation/Puntetoekenning

- $n(A_2)$ formed/gevorm = 2,25 ✓
- USING ratio/GEBRUIK verhouding: 2:1:1 ✓
- Equilibrium: $n(XA_2)$ & $n(X_2A_2)$ = initial $\pm$ change ✓
Ewewig: : $n(XA_2)$ & $n(X_2A_2)$ = aanvanklik $\pm$ verandering
- Divide by volume/Gedeel deur volume (0,5 dm³) ✓
- Correct K_c expression (formulae in square brackets). ✓
Korrekte K_c -uitdrukking (formules tussen vierkantjies).
- Substitution of reactant and product concentrations/Vervanging van reaktans- en produkonsentrasies. ✓
- **Correct final answer/Korrekte finale antwoord**: 20,25 ✓

	$2XA_2(g)$	$X_2A_2(g)$	$A_2(g)$
Initial moles /Aanvanklik mol	5	0	0
change/verandering	(-) 4,5 (ratio) ✓	(+) 2,25	(+) 2,25 ✓
Equilibrium/Ewewig (moles / mol)	5-4,5 = 0,5 ✓	2,25	2,25
Concentration / Konsentraie	$c = \frac{0,5}{0,5} = 1,0$	$c = \frac{2,25}{0,5} = 4,5$	$c = \frac{2,25}{0,5} = 4,5$

$\div 0,5$ ✓

$$K_c = \frac{[X_2 A_2] [A_2]}{[X A_2]^2} = \frac{(4,5)(4,5)}{(1,0)^2} = 20,25 \quad (7)$$

- 6.6.1 [products] > .[reagents] ✓ / [produkte] > .[reagente] (1)

- 6.6.2 0,054 ✓ (1)
[19]

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QUESTION 7/VRAAG 7

7.1.1 A proton (H^+) donar ✓/In Suur is 'n proton (H^+) skenker ✓ (2)

7.1.2 It can donate 2 protons✓/ 2 H^+ ions per H_2SO_4 molecule /
 Dit kan 2 protone skenk✓ / 2 H^+ ione per H_2SO_4 molekule vorm (1)

7.1.3 It ionises completely in water✓ to form a high concentration of
 H_3O^+ ions. (1)
 Dit ioniseer feitlik volledig in water en vorm 'n hoë konsentrasie H_3O^+ ione

7.1.4 Sulphate ion✓ / SO_4^{2-} / sulfaat-ioon (1)

7.1.5 Ampholyte /amphiprotic substance✓/Amfoliet / amfiprotiese stof (1)

7.2

$n = \frac{m}{M} = \frac{0,32}{106} = 0,003 \text{ mol}$ $Na_2CO_3 : HCl$ $0,003 : 0,006$ ✓ $c_{HCl} = \frac{n}{V} = \frac{0,006}{0,1} = 0,06 \text{ mol} \cdot \text{dm}^{-3}$ $c_1 V_1 = c_2 V_2$ $c_1 \times 10 = 0,06 \times 500$ ✓ $c_1 = 3 \text{ mol} \cdot \text{dm}^{-3}$ ✓	Marking Criteria/Nasiengiglyne • Substitution/Vervang $M=106$ ✓ • Calculate/Bereken $n(Na_2CO_3)$ $= 0,003 \text{ mol}$ ✓ • Use ratios/Gebruik molverhouding: $n(HCl) = n(Na_2CO_3)$ ✓ • Calculate/Bereken c_{HCl} ✓ • Substitute/Vervang $c_1 \times 10$ ✓ • Substitution/Vervang $0,06 \times 500$ ✓ • Final answer: $3 \text{ mol} \cdot \text{dm}^{-3}$ ✓
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(7)

[13]

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QUESTION 8/VRAAG 8

- 8.1 Reduction ✓/Reduksie ✓ (1)
- 8.2 A substance that gains electrons ✓ /Stof wat elektrone ontvang ✓ (2)
- 8.3 Silver nitrate ✓ /Silwernitraat ✓ (1)
- 8.4 From D to silver ✓ /Van D na die silwer ✓ (1)
- 8.5 $E_{\text{cell}}^0 = E_{\text{cathode}}^0 - E_{\text{anode}}^0$ ✓ (any equation on data sheet)
2,46 ✓ = (+0,8) ✓ - E_{anode}^0 ✓
 $E_{\text{anode}}^0 = -1,66 \text{ V}$ ✓ (4)
- 8.6 Aluminium / Al ✓ (1)
- 8.7 POSITIVE MARKING FROM QUESTION 8.6/POSITIEWE NASIEN
VANAF VRAAG 8.6
 $\text{Al(s)} \mid \text{Al}^{3+}(\text{aq}) (1 \text{ mol} \cdot \text{dm}^{-3}) \parallel \text{Ag}^+(\text{aq}) (1 \text{ mol} \cdot \text{dm}^{-3}) \mid \text{Ag(s)} \parallel$ ✓
OF/OR
 $\text{Al} \mid \text{Al}^{3+} \parallel \text{Ag}^+ \mid \text{Ag}$ ✓ (3)
- 8.8 Decreases ✓ / Neem af. ✓
 $\text{Ag}^+(\text{aq}) + \text{Ct}^-(\text{aq}) \rightarrow \text{AgCl(s)} \mid \text{AgCl(s)}$ forms $[\text{Ag}^+]$ decreases ✓
Silwerchloried vorm wat 'n neerslag is /, die Ag^+ - konsentrasie verlaag ✓ (2)

[15]

QUESTION 9/VRAAG 9

- 9.1 A solution/liquid/dissolved substance that conducts electricity ✓ through the movement of ions / because it contains ions ✓
'n Elektroliet is 'n oplossing/vloeistof/stof wat ione bevat ✓ en dus stroom kan geleel. ✓ (2)
- 9.2.1 $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$ ✓ ✓ (2)
- | | | | |
|---|---------------|---|---------------|
| $2\text{Cl}^- = \text{Cl}_2 + 2\text{e}^-$ | $\frac{1}{2}$ | $\text{Cl}_2 + 2\text{e}^- \leftarrow 2\text{Cl}^-$ | $\frac{2}{2}$ |
| $2\text{Cl}^- \leftarrow \text{Cl}_2 + 2\text{e}^-$ | $\frac{0}{2}$ | $\text{Cl}_2 + 2\text{e}^- = 2\text{Cl}^-$ | $\frac{0}{2}$ |
- 9.2.2 $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ ✓ ✓ (2)
- | | | | |
|---|---------------|---|---------------|
| $\text{Cu}^{2+} + 2\text{e}^- = \text{Cu}$ | $\frac{1}{2}$ | $\text{Cu} \leftarrow \text{Cu}^{2+} + 2\text{e}^-$ | $\frac{2}{2}$ |
| $\text{Cu}^{2+} + 2\text{e}^- \leftarrow \text{Cu}$ | $\frac{0}{2}$ | $\text{Cu} = \text{Cu}^{2+} + 2\text{e}^-$ | $\frac{0}{2}$ |

NOTE: if swapped answers for Questions 9.2.1 and 9.2.2 but everything else correct 2/4/ Indien antwoorde vir Vraë 9.2.1 en 9.2.2 omgeruil 2/4

- 9.3 Q ✓
Reduction occurs there ✓ / Cu^{2+} is reduced at Q / Cu^{2+} is an oxidising agent / Reduksie vind daar plaas ✓ (2)
- 9.4.1 Cu is a better reducing agent ✓ than Ct^- ✓ and thus Cu will be oxidised to Cu^{2+} ✓. (no Cl_2 gas formed but Cu will dissolve/break up)
Cu is 'n beter reduseermiddel ✓ as Ct^- ✓ en sal dus na Cu na Cu^{2+} geoksideer word. ✓ (3)

- 9.4.2 P ✓ (1)
[12]

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QUESTION 10/VRAAG 10

- 10.1 Ostwald process ✓ /Ostwald-proses ✓ (1)
- 10.2 NO ✓ and/ en H₂O ✓ (2)
- 10.3 NH₃ + HNO₃ ✓ → NH₄NO₃ ✓ (bal ✓) (3)
- 10.4 To have all 3 primary nutrients /To mix a fertilizer with N P and K ✓ /
Om 'te verkry wat al drie die primêre voedingstwe (N, P en K) bevat. ✓ (1)

10.5 Option 1/ Opsie 1

Option 2/ Opsie 2

$$n = \frac{m}{M} = \frac{6,8 \times 10^4}{17} \checkmark = 4 \times 10^3 \text{ mol}$$

2 mol NH₃ produces 1 mol (NH₄)₂SO₄

∴ 4 × 10³ mol NH₃ produces 2 × 10³ mol (NH₄)₂SO₄ ✓

∴ m = nM = 2 × 10³ × 130 ✓

= 2,6 × 10⁵ g ✓

∴ 2,6 × 10² kg ✓ (2 600 kg) ✓ (NH₄)₂SO₄

2 mol NH₃ produces 1 mol (NH₄)₂SO₄

∴ 34g NH₃ ✓ (uses 17) produces 130 g (NH₄)₂SO₄ ✓ (uses 130) ✓ (ratio)

∴ 6,8 × 10⁴ g NH₃ produces x g (NH₄)₂SO₄

∴ 34x = (130)(6,8 × 10⁴)

x = 2,6 × 10⁵ g

∴ 2,6 × 10² kg NH₄NO₃ ✓ formed/gevorm

Marking criteria/ Nasien riglyn

- Use of 17 in $n = \frac{m}{M}$ ✓
- Use of ratio NH₃ : (NH₄)₂SO₄ = 2:1 ✓
- Use of molar mass of (NH₄)₂SO₄ = 130 ✓
- Final answer correct ✓

TOTAL: 150 [11]

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