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**SENIOR CERTIFICATE/SENIOR SERTIFIKAAT
NATIONAL SENIOR CERTIFICATE/
NASIONALE SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

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

SEPTEMBER 2021(2)

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

**This memorandum consists of 17 pages.
*Hierdie memorandum bestaan uit 17 bladsye.***

QUESTION 1/VRAAG 1

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

QUESTION 2/VRAAG 2

2.1

2.1.1 C ✓ (1)

2.1.2 B/E ✓ (1)

2.1.3 E ✓ (1)

2.2

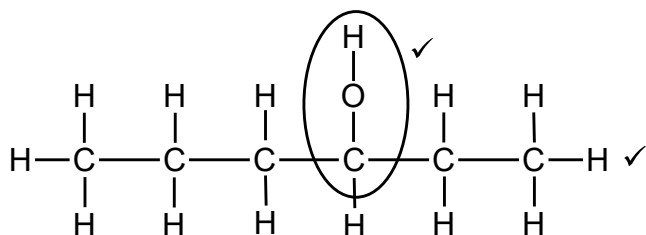
2.2.1 2-bromo-4-ethyl-3,3-dimethylhexane/2-broom-4-etiel-3,3-dimetielheksaan

Marking criteria/Nasienkriteria

- Correct stem i.e. hexane./Korrekte stam: heksaan. ✓
- All substituents (bromo, ethyl and dimethyl) correctly identified./Alle substituenten (broom, etiel en dimetiel) korrek geïdentifiseer. ✓
- Substituents correctly numbered, in alphabetical order, hyphens and commas correctly used./Substituenten korrek genommer, in alfabetiese volgorde, koppeltekens en kommas korrek gebruik. ✓

(3)

2.2.2



Marking criteria/Nasienkriteria:

- Six carbons in longest chain. Ses koolstowwe in die langste ketting. ✓
- Hydroxyl group on third carbon./Hidroksielgroep op tweede koolstof. ✓

Notes/Aantekeninge:

- One or more H atoms omitted/Een of meer H-atome uitgelaat: $\frac{1}{2}$
- Condensed or semi-structural formula./Gekondenseerde of semi-struktuurformule: $\frac{1}{2}$

(2)

2.2.3 Pentanal / Pentanaal ✓✓

Marking criteria/Nasienkriteria:

- Correct functional group i.e. -al/Korrekte funksionele groep d.i. -al. ✓
- Whole name correct/Hele naam korrek. ✓✓

(2)

2.3

2.3.1 Oxidation/combustion/oksidasie/verbranding ✓ (1)

2.3.2 C_8H_{18} ✓✓ (2 or/of 0) (2)

2.3.3

OPTION 1/OPSIE 1 $V(\text{CO}_2) = 8 \times V_B$ $= 8(50)$ $= 400 \text{ cm}^3$ $V(\text{H}_2\text{O}) = \frac{18}{2} V_B$ $= 9(50)$ $= 450 \text{ cm}^3$ Total volume gas formed/ Totale volume gas gevorm $= 400 + 450$ $= 850 \text{ cm}^3 \checkmark$	Marking criteria/Nasienkriteria - Use volume ratio/Gebruik volume verhouding: $V(\text{CO}_2) : V(\text{B}) = 2 : 1$ and/en $V(\text{H}_2\text{O}) : V(\text{B}) = 9 : 1 \checkmark$ - Add/Tel bymekaar: $V(\text{CO}_2)$ and/en $V(\text{H}_2\text{O}) \checkmark$ - Final answer/Finale antwoord: $850 \text{ cm}^3 \checkmark$ OPTION 2/OPSIE 2 2 mol C_xH_y $16 + 18 = 34 \text{ mol gas}$ 50 mol C_xH_y $25 \times 34 \checkmark \text{ mol gas}$ Total moles gas formed/Totale volume gas gevorm = $850 \text{ cm}^3 \checkmark$
--	---

(3)
[16]**QUESTION 3/VRAAG 3**3.1 No/Nee $\checkmark$

(1)

3.2  There is more than one independent variable. $\checkmark$
 Daar is meer as een onafhanklike veranderlike.

OR/OF

Positions of functional groups and branching/chain length differ.

*Posises van funksionele groepe en vertakking/kettinglengte verskil.***OR/OF**Compounds **A** and **B/C** are positional isomers and compounds **B** and **C** are chain isomers.*Verbindings **A** en **B/C** is posisie-isomere en verbindings **B** en **C** is kettingisomere.*

(1)

- 3.3
- B/butan-2-ol is less branched / less compact / less spherical/ has a longer chain length / has a larger surface area (over which intermolecular forces act). ✓
 - B/butan-2-ol has stronger / more intermolecular forces / Van der Waals forces / London forces / dispersion forces. ✓
 - More energy needed to overcome or break intermolecular forces / Van der Waals forces in B/butan-2-ol. ✓
 - B/butan-2-ol is minder vertak / minder kompak / minder sferies / het 'n langer kettinglengte / het 'n groter oppervlak (waaroor intermolekulêre kragte werk).
 - B/butan-2-ol het sterker / meer intermolekulêre kragte / Van der Waalskragte / London-kragte / dispersiekragte.
 - Meer energie benodig om intermolekulêre kragte / Van der Waalskragte/ dispersiekragte / London-kragte te oorkom in B/butan-2-ol.

OR/OF

- C/2-methylpropan-2-ol is more branched / more compact / more spherical / has a smaller surface area (over which intermolecular forces act). ✓
- C/2-methylpropan-2-ol has weaker / less intermolecular forces / Van der Waals forces / London forces / dispersion forces. ✓
- Less energy needed to overcome or break intermolecular forces / Van der Waals forces in C/2-methylpropan-2-ol. ✓
- C/2-metielpropan-2-ol is meer vertak / meer kompak / meer sferies / het 'n kleiner oppervlak (waaroor intermolekulêre kragte werk).
- C/2-metielpropan-2-ol het swakker/minder intermolekulêre kragte / Van der Waalskragte / Londonkragte / dispersiekragte.
- Minder energie benodig om intermolekulêre kragte / Van der Waalskragte/ dispersiekragte / Londonkragte te oorkom in C/2-metielpropan-2-ol.

(3)

3.4

Marking criteria/Nasienkriteria

If any one of the underlined key phrases in the **correct context** is omitted, deduct 1 mark./Indien enige van die onderstreepte frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.

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)

3.5

3.5.1 A & B ✓

(1)

3.5.2 C ✓

The C-atom bonded to the functional group/OH-group/hydroxyl (group) is bonded to three other C-atoms. ✓

Die C-atoom aan die funksionele groep/OH-groep/hidroksiel(groep) gebind is, is aan drie ander C-atome gebind.

OR/OF

The functional group/OH-group/hydroxyl (group) is bonded to a tertiary C-atom.

Die funksionele groep/OH-groep/hidroksiel(groep) is aan 'n tersiêre C-atoom gebind.

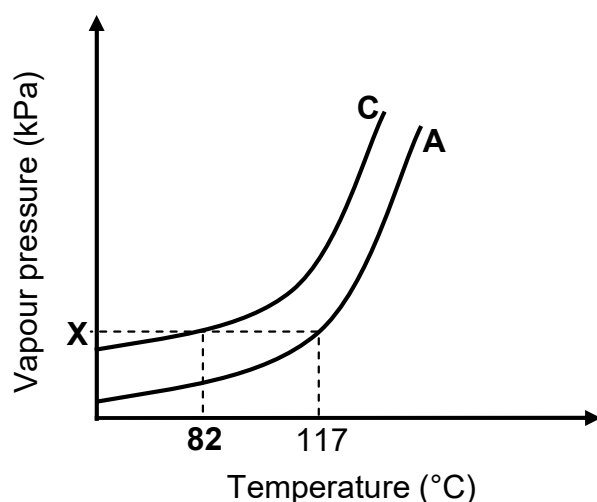
(2)

3.6

3.6.1 101,3 (kPa) / $1,013 \times 10^5$ Pa / 1 atm / 760 mmHg ✓

(1)

3.6.2



Marking criteria/Nasienkriteria:

- Curve C is above A.
Kurwe C is bokant A. ✓
- Value 82 °C on curve C where vapour pressure is X/
101,3 kPa.
*Waarde 82 °C op kurwe C waar dampdruk gelyk is aan X/
101,3 kPa. ✓*

IF/INDIEN:

- Curves start at same point/*Indien kurwes by dieselfde punt begin:*
Max./Maks. $\frac{1}{2}$
- Straight line graph/*Reguitlyn grafiek.* Max./Maks. $\frac{1}{2}$

(2)

[13]

QUESTION 4/VRAAG 4

4.1

4.1.1 Substitution/halogenation/bromination ✓
Substitusie/halogenering/brominerig (1)

4.1.2 Substitution/hydrolysis/*Substitusie/hidrolise* ✓ (1)

4.1.3 1-bromopropane/1-bromopropaan ✓✓

IF/INDIEN:

Bromopropane/bromopropaan **OR/OF**

2-bromopropane/2-bromopropaan

Max./Maks. $\frac{1}{2}$

(2)

4.1.4 H_2SO_4 /(concentrated) sulphuric acid/(gekonsentreerde)

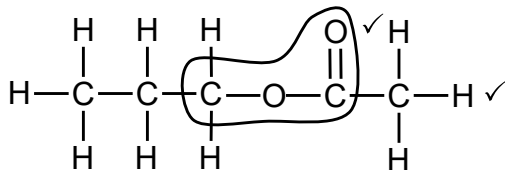
swaelsuur ✓

(1)

4.1.5 Ethanoic acid/Etanoësuur ✓✓

(2)

4.1.6



Marking criteria/Nasienkriteria:

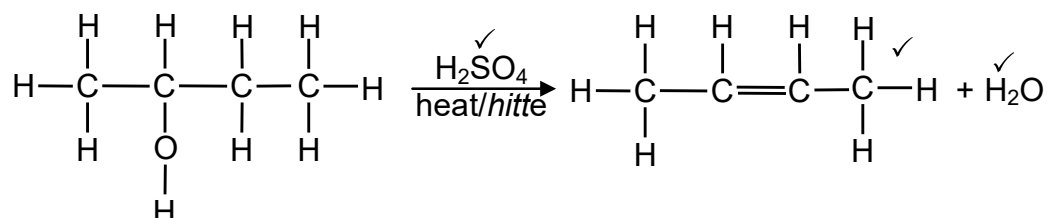
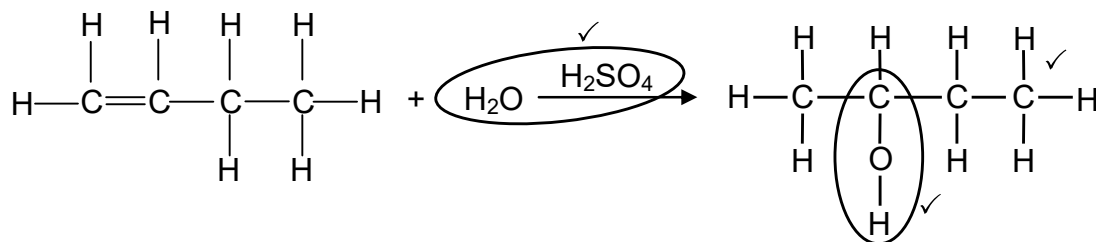
- Functional group correct. ✓
Funksionele groep korrek.
- Whole structure correct. ✓✓
Hele struktuur korrek.

Notes/Aantekeninge:

- One or more H atoms omitted: / *Een of meer H-atome uitgelaat:* $\frac{1}{2}$
- Condensed or semi-structural formula: / *Gekondenseerde of semi-struktuur-formule:* $\frac{1}{2}$

(2)

4.2

**Notes/Aantekeninge:**

- | | |
|--|---------------------------------------|
| • Condensed or semistructural formula: | Max. $\frac{5}{6}$ |
| <i>Gekondenseerde of semistruktuurformule:</i> | <i>Maks. $\frac{5}{6}$</i> |
| • Molecular formula/ <i>Molekulêre formule:</i> | Max./Maks. $\frac{3}{6}$ |
| • Marking rule 6.3.10/ <i>Nasienreël 6.3.10.</i> | |
| • Any additional reactants or products: | Max. $\frac{5}{6}$ |
| <i>Enige addisionele reaktanse of produkte:</i> | <i>Maks. $\frac{5}{6}$</i> |
| • If arrow in equation omitted: | Max. $\frac{5}{6}$ |
| <i>Indien pyltjie in vergelyking uitgelaat is:</i> | <i>Maks. $\frac{5}{6}$</i> |

(6)
[15]

QUESTION 5/VRAAG 5

5.1

5.1.1 Kinetic energy/*kinetiese energie* ✓ (1)

5.1.2 Number of particles/molecules ✓
Aantal deeltjies/molekule

(1)

5.2

5.2.1 Activation energy/*Aktiveringsenergie* ✓ (1)

5.2.2 Increase/*Toeneem* ✓

(1)

5.3

- A catalyst provides an alternative pathway of lower activation energy. ✓
- More molecules have sufficient kinetic energy. ✓
- More effective collisions per unit time. / Frequency of effective collisions increases. ✓
- Increase reaction rate. ✓
- 'n Katalisator verskaf 'n alternatiewe roete van laer aktiveringsenergie.
- Meer molekule het voldoende kinetiese energie.
- Meer effektiewe botsings per eenheidtyd. / Frekwensie van effektiewe botsings neem toe.
- Verhoog reaksietempo. ✓

(4)

5.4

5.4.1 Temperature / Surface area / Amount or mass of CaCO_3 ✓
Temperatuur / Reaksie-oppervlak / Hoeveelheid of massa CaCO_3 (1)

5.4.2

Criteria for conclusion/Kriteria vir gevolgtrekking:

Dependent (reaction rate) and independent (concentration) variables correctly identified. / *Afhanklike (reaksietempo) en onafhanklike (konsentrasie) veranderlikes korrek geïdentifiseer.*

✓

Relationship between the independent and dependent variables correctly stated. / *Verwantskap tussen die afhanklike en onafhanklike veranderlikes korrek genoem.*

✓

Example/Voorbeeld:

Reaction rate is directly proportional to concentration.
Reaksietempo is direk eweredig aan konsentrasie.

IF/INDIEN

Reaction rate increases with increase in concentration.
Reaksietempo neem toe met toename in konsentrasie.

OR/OF

Reaksietempo is eweredig aan konsentrasie.

Reaction rate is proportional to concentration.

Max./Maks. $\frac{1}{2}$

(2)

5.5

Marking criteria/Nasienkriteria:

- Substitute $50 \text{ cm}^3 \cdot \text{min}^{-1}$ and 26 minutes in rate $= \frac{\Delta V}{\Delta t}$ ✓
- Substitute/ Vervang $1\,300 \text{ cm}^3 / 1,3 \text{ dm}^3$ **OR/OF** $24\,000 \text{ cm}^3 \cdot \text{mol}^{-1} / 24 \text{ dm}^3 \cdot \text{mol}^{-1}$ in $n = \frac{V}{V_m}$ ✓
- Use ratio/Gebruik verhouding $n(\text{CO}_2) = n(\text{CaCO}_3) = 1:1$ ✓
- Substitute/Vervang $100 \text{ g} \cdot \text{mol}^{-1}$ in $n = \frac{m}{M}$ ✓
- Calculate % purity/Bereken % suiwerheid $= \frac{m(\text{CaCO}_3)}{m(\text{Sample/ monster})} \times 100$ ✓
- Final answer/Finale antwoord: 90,33% ✓
Range/Gebied: 83,33% to 90,33%

OPTION 1

$$\begin{aligned} \text{Rate/tempo} &= \frac{\Delta V}{\Delta t} \\ 50 &= \frac{\Delta V}{26} \checkmark \\ \Delta V &= 1\,300 \text{ cm}^3 \\ n(\text{CO}_2) &= \frac{1\,300}{24\,000} \checkmark \text{ OR } \frac{1,3}{24} \\ &= 0,0542 \text{ mol} \\ n(\text{CaCO}_3) &= n(\text{CO}_2) \\ &= 0,0542 \text{ mol} \checkmark \\ m(\text{CaCO}_3) &= nM \\ &= 0,0542 \times 100 \checkmark \\ &= 5,42 \text{ g} \\ \% \text{ purity/suiwerheid} &= \frac{5,42}{6} \checkmark \times 100 \\ &= 90,33\% \checkmark \end{aligned}$$

OPTION 2:

$$\begin{aligned} \text{Rate/tempo} &= \frac{50}{24\,000} \checkmark \\ &= 0,00208 \text{ mol} \cdot \text{min}^{-1} \checkmark \\ n(\text{CO}_2) &= 0,00208 \times 26 \\ &= 0,0542 \text{ mol} \\ n(\text{CaCO}_3) &= n(\text{CO}_2) = 0,0542 \text{ mol} \checkmark \\ m(\text{CaCO}_3) &= nM \\ &= 0,0542(100) \checkmark \\ &= 5,42 \text{ g} \\ \% \text{ purity/suiwerheid} &= \frac{5,42}{6} \checkmark \times 100 \\ &= 90,33\% \checkmark \end{aligned}$$

(6)
[17]

QUESTION 6/VRAAG 6

- 6.1 The stage in a chemical reaction when the rate of forward reaction equals the rate of reverse reaction. ✓✓ (2 or 0)

Die stadium in 'n chemiese reaksie waar die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie. (2 of 0)

OR/OF

The stage in a chemical reaction when the concentrations of reactants and products remain constant. (2 or 0)

Die stadium in 'n chemiese reaksie waar die konsentrasies van die reaktanse en produkte konstant bly. (2 of 0)

(2)

- 6.2 **CALCULATIONS USING NUMBER OF MOLES**
BEREKENINGE WAT AANTAL MOL GEBRUIK

Marking criteria/Nasienkriteria

- Substitute/Vervang $18 \text{ g} \cdot \text{mol}^{-1}$ in $n = \frac{m}{M}$ ✓
- $\Delta n(\text{CO}_2) = \Delta n(\text{C}) = 0,225 \text{ mol}$. ✓
- Use mole ratio/Gebruik $n(\text{C}) : n(\text{H}_2\text{O}) : n(\text{CO}_2) : n(\text{H}_2) = 1 : 2 : 1 : 2$ ✓
- Equilibrium/Ewewig $n(\text{H}_2\text{O}) = \text{initial/aanvanklike } n(\text{H}_2\text{O}) - \Delta n(\text{H}_2\text{O})$ } ✓
Equilibrium/Ewewig $n(\text{H}_2) = \text{initial/aanvanklike } n(\text{H}_2) + \Delta n(\text{H}_2)$
Equilibrium/Ewewig $n(\text{CO}_2) = \text{initial/aanvanklike } n(\text{CO}_2) + \Delta n(\text{CO}_2)$
- Divide equilibrium moles of H_2O , H_2 AND/EN CO_2 by/deur 2 dm^3 . ✓
- Correct K_c expression (formulae in square brackets). ✓
Korrekte K_c uitdrukking (formules in vierkantige hakies).
- Substitution of concentrations into correct K_c expression. ✓
Vervanging van konsentrasies in korrekte K_c -uitdrukking.
- Final answer/Finale antwoord: 0,00948 ✓
Range/Gebied: 0,00948 to/tot 0,01 ($9,48 \times 10^{-3}$ to/tot 1×10^{-2})

OPTION 1/OPSIE 1

$$n(\text{H}_2\text{O})_{\text{initial/aanvanklik}} = \frac{m}{M} = \frac{36}{18} = 2 \text{ mol}$$

	H_2O	H_2	CO_2
Initial amount (moles) <i>Aanvangs hoeveelheid (mol)</i>	2		
Change in amount (moles) <i>Verandering in hoeveelheid (mol)</i>	0,45	0,45	0,225 ✓
Equilibrium amount (moles) <i>hoeveelheid (mol)</i>	1,55	0,45	0,225 ✓
Equilibrium concentration ($\text{mol} \cdot \text{dm}^{-3}$) <i>Ewewigskonsentrasie ($\text{mol} \cdot \text{dm}^{-3}$)</i>	0,775	0,225	0,1125

ratio ✓
verhouding

Divide by/
Deel deur
 2 dm^3 ✓

$$K_c = \frac{[\text{H}_2]^2 [\text{CO}_2]}{[\text{H}_2\text{O}]^2}$$

$$= \frac{[0,225]^2 [0,1125]}{[0,775]^2}$$

$$= 0,00948 \text{ ✓}$$

No K_c expression, correct substitution/Geen K_c -uitdrukking, korrekte substitusie: Max./Maks. $\frac{7}{8}$

Wrong K_c expression/Verkeerde K_c -uitdrukking:
Max./Maks. $\frac{5}{8}$

CALCULATIONS USING CONCENTRATION**BEREKENINGE WAT KONSENTRASIE GEBRUIK**

- Substitute/Vervang $18 \text{ g} \cdot \text{mol}^{-1}$ in $n = \frac{m}{M}$ ✓
- Divide initial/Deel aanvanklike $n(\text{H}_2\text{O})$ AND $\Delta n(\text{CO}_2)$ by/deur 2 dm^3 . ✓
- $\Delta n(\text{CO}_2) = \Delta n(\text{C}) = 0,225 \text{ mol}$ OR/OF $\Delta c(\text{CO}_2) = 0,1125 \text{ mol} \cdot \text{dm}^{-3}$. ✓
- Use mole ratio/Gebruik molverhouding $n(\text{H}_2\text{O}) : n(\text{CO}_2) : n(\text{H}_2) = 2 : 1 : 2$ ✓
- Equilibrium/Ewewig $c(\text{H}_2\text{O}) = \text{initial/aanvanklike } c(\text{H}_2\text{O}) - \Delta c(\text{H}_2\text{O})$ } ✓
 Equilibrium/Ewewig $c(\text{H}_2) = \text{initial/aanvanklike } c(\text{H}_2) + \Delta c(\text{H}_2)$
 Equilibrium/Ewewig $c(\text{CO}_2) = \text{initial/aanvanklike } c(\text{CO}_2) + \Delta c(\text{CO}_2)$
- Correct K_c expression (formulae in square brackets). ✓
 Korrekte K_c uitdrukking (formules in vierkantige hakies).
- Substitution of concentrations into correct K_c expression. ✓
 Vervanging van konsentrasies in korrekte K_c -uitdrukking.
- Final answer/Finale antwoord: $0,00948$ ✓
 Range/Gebied: $0,00948 - 0,01$

OPTION 2/OPSIE 2

$$n(\text{H}_2\text{O})_{\text{initial/aanvanklik}} = \frac{m}{M} = \frac{36}{18} = 2 \text{ mol}$$

	H ₂ O	H ₂	CO ₂
Initial concentration (mol·dm ⁻³) Aanvangskonsentrasie (mol·dm ⁻³)	1		
Change (mol·dm ⁻³) Verandering (mol·dm ⁻³)	0,225	0,225	0,1125 ✓
Equilibrium concentration (mol·dm ⁻³) Ewewigskonsentrasie (mol·dm ⁻³)	0,775	0,225	0,1125

Divide by/
Deel deur
 2 dm^3 ✓
ratio ✓
verhouding

$$K_c = \frac{[\text{H}_2]^2 [\text{CO}_2]}{[\text{H}_2\text{O}]^2}$$

$$= \frac{[0,225]^2 [0,1125]}{[0,775]^2}$$

$$= 0,00948 \text{ ✓}$$

No K_c expression, correct substitution/Geen K_c -
uitdrukking, korrekte substitusie: Max./Maks. $\frac{7}{8}$

Wrong K_c expression/Verkeerde K_c -uitdrukking:
Max./Maks. $\frac{5}{8}$

(8)

6.3

6.3.1 Steam is used up./Amount of steam decreases./Concentration of steam decreases./Reactants are used up. ✓
 Water word opgebruik./Hoeveelheid stoom neem af./Konsentrasie van stoom neem af./Reaktanse word opgebruik.

(1)

6.3.2 Catalyst was added./Katalisator is bygevoeg. ✓

(1)

6.3.3 Endothermic/Endotermies ✓

(1)

- 6.3.4
- The forward reaction is favoured./Die voorwaartse reaksie word bevoordeel. ✓
 - Increase in temperature favours the endothermic reaction. ✓
 Toename in temperatuur bevoordeel die endotermiese reaksie.

(2)

[15]

QUESTION 7/VRAAG 7

- 7.1 A base forms hydroxide ions (OH^-) in water/aqueous solution/ $\text{OH}^-(\text{aq})$. ✓✓
'n Basis vorm hidroksiedione (OH^-) in water/waterige oplossing/ $\text{OH}^-(\text{aq})$.

IF/INDIEN:

A base ionises to form hydroxide ions (OH^-). ✓

'n Basis ioniseer om hidroksiedione (OH^-) te vorm.

Max./Maks. $\frac{1}{2}$

(2)

- 7.2 $n(\text{KOH}) = cV$
 $= 0,1 \times 0,4$ ✓
 $= 0,04 \text{ mol}$
 $n(\text{OH}^-) = n(\text{KOH}) = 0,04 \text{ mol}$ ✓

(2)

7.3

7.3.1 **POSITIVE MARKING FROM Q7.2/POSITIEWE NASIEN VANAF V7.2**

Marking criteria/Nasienkriteria

- Use formula/Gebruik formule: $\text{pH} = -\log[\text{H}_3\text{O}^+]$
- Substitute/Vervang $\text{pH} = 13/\text{pOH} = 1$
- Substitute/Vervang 1×10^{-13} in K_w /Calculate/Bereken pOH
- Substitute/Vervang of $0,1 \times 0,9$
- Calculate/Bereken $n(\text{OH}^-) = n(\text{in C}) - n(\text{in B})$ ✓
- Use mol ratio/Gebruik molverhouding: $n(\text{Ba}(\text{OH})_2) : n(\text{OH}^-) = 1 : 2$. ✓
- Substitute/Vervang $0,5 \text{ dm}^3$. ✓
- Final answer/Finale antwoord: $0,05 \text{ mol} \cdot \text{dm}^{-3}$ ✓
Range/Gebied: $0,05$ to $0,06 \text{ mol} \cdot \text{dm}^{-3}$

OPTION 1/OPSIE 1

$$\begin{aligned} \text{pH} &= -\log[\text{H}_3\text{O}^+] \quad \text{OR/OF} \quad [\text{H}_3\text{O}^+] = 10^{-\text{pH}} \quad \checkmark \\ 13 \checkmark &= -\log[\text{H}_3\text{O}^+] \quad \text{OR/OF} \quad [\text{H}_3\text{O}^+] = 10^{-13} \\ [\text{H}_3\text{O}^+] &= 1 \times 10^{-13} \text{ mol} \cdot \text{dm}^{-3} \\ \swarrow & \\ [\text{H}_3\text{O}^+][\text{OH}^-] &= 1 \times 10^{-14} \\ (1 \times 10^{-13}) [\text{OH}^-] &= 1 \times 10^{-14} \quad \checkmark \\ [\text{OH}^-] &= 0,1 \text{ mol} \cdot \text{dm}^{-3} \\ \downarrow & \\ n(\text{OH}^-) &= cV \\ &= 0,1 \times 0,9 \quad \checkmark \\ &= 0,09 \text{ mol} \end{aligned}$$

OPTION 2/OPSIE 2

$$\begin{aligned} \text{pOH} &= 14 - 13 = 1 \quad \checkmark \\ \text{pOH} &= -\log[\text{OH}^-] \quad \checkmark \\ 1 \checkmark &= -\log[\text{OH}^-] \\ [\text{OH}^-] &= 0,1 \text{ mol} \cdot \text{dm}^{-3} \\ \downarrow & \\ n(\text{OH}^-) &= cV \\ &= 0,1 \times 0,9 \quad \checkmark \\ &= 0,09 \text{ mol} \end{aligned}$$

$$\begin{aligned} n(\text{OH}^-) \text{ from/van } \text{Ba}(\text{OH})_2 \text{ in beaker/beker C} &= 0,09 - 0,04 \quad \checkmark \\ &= 0,05 \text{ mol} \end{aligned}$$

$$\begin{aligned} n[\text{Ba}(\text{OH})_2] &= \frac{1}{2} n(\text{OH}^-) \\ &= \frac{1}{2} (0,05) \quad \checkmark \\ &= 0,025 \text{ mol} \end{aligned}$$

$$\begin{aligned} c[\text{Ba}(\text{OH})_2] &= \frac{n}{V} \\ &= \frac{0,025}{0,5} \quad \checkmark \end{aligned}$$

$$\therefore x = 0,05 \text{ mol} \cdot \text{dm}^{-3} \quad \checkmark$$

(8)

7.3.2 Weak (acid)/Swak (suur) ✓



Ionises/dissociates incompletely/partially. ✓
Ioniseer/dissosieer onvolledig/gedeeltelik.

(2)

7.3.3 **POSITIVE MARKING FROM Q7.3.1/POSITIEWE NASIEN VANAF V7.3.1**

Marking criteria/Nasienkriteria

- Formula/Formule: $c = \frac{n}{V} / \frac{c_a \times V_a}{c_b \times V_b} = \frac{n_a}{n_b}$ ✓
- Substitution of/Vervanging van $0,1 \times 15 / 0,1 \times 0,015$ ✓ **OR/OF**
Use/Gebruik $V_a = 30 \text{ cm}^3$
- Use mol ratio/Gebruik molverhouding $1 : 1$ ✓
- Final answer/Finale antwoord: $0,05 \text{ mol} \cdot \text{dm}^{-3}$ ✓

OPTION 1/OPSIE 1

$$\begin{aligned} n(\text{OH}^-) &= cV \quad \checkmark \\ &= 0,1 \times 0,015 \quad \checkmark \\ &= 0,0015 \text{ mol} \\ n(\text{CH}_3\text{COOH}) &= n(\text{OH}^-) \\ &= 0,0015 \text{ mol} \quad \checkmark \\ c &= \frac{n}{V} \\ &= \frac{0,0015}{0,03} \\ &= 0,05 \text{ mol} \cdot \text{dm}^{-3} \quad \checkmark \end{aligned}$$

OPTION 2/OPSIE 2

$$\begin{aligned} \frac{c_a \times V_a}{c_b \times V_b} &= \frac{n_a}{n_b} \quad \checkmark \\ \frac{c_a \times 30}{0,1 \times 15} \quad \checkmark &= \frac{1}{1} \quad \checkmark \\ c_a &= 0,05 \text{ mol} \cdot \text{dm}^{-3} \quad \checkmark \end{aligned}$$

(4)
[18]

QUESTION 8/VRAAG 8

8.1

8.1.1 Zinc/Zn ✓ (1)

8.1.2 Platinum/Pt /Carbon/C/Koolstof ✓ (1)

8.1.3 Iron(III) ions/ $\text{Fe}^{3+}(\text{aq})$ / Fe^{3+} ions/Yster(III)-ione/ Fe^{3+} -ione ✓ (1)

8.2

8.2.1 Conductor (to complete circuit). /Provides surface area for the reaction to take place. ✓
Geleier (om die stroombaan te voltooi./Verskaf oppervlak vir die reaksie om plaas te vind. (1)

8.2.2 $\text{Fe}^{3+} + \text{e}^- \rightarrow \text{Fe}^{2+}$ ✓✓

Marking criteria/Nasienkriteria

- $\text{Fe}^{3+} + \text{e}^- \rightleftharpoons \text{Fe}^{2+}$ $\frac{1}{2}$ $\text{Fe}^{2+} \rightleftharpoons \text{Fe}^{3+} + \text{e}^-$ $\frac{0}{2}$
- $\text{Fe}^{2+} \leftarrow \text{Fe}^{3+} + \text{e}^-$ $\frac{2}{2}$ $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{e}^-$ $\frac{0}{2}$
- Ignore if charge omitted on electron. /Ignoreer indien lading weggelaat op elektron.
- If charge (+) omitted on Fe^{2+} and/or Fe^{3+} Indien lading (+) weggelaat op Fe^{2+} and/or Fe^{3+} Max./Maks: $\frac{1}{2}$ Example/Voorbeeld: $\text{Fe}^3 + \text{e}^- \rightarrow \text{Fe}^2$

(2)

8.2.3 $2\text{Fe}^{3+}(\text{aq}) + \text{Zn} \checkmark \rightarrow 2\text{Fe}^{2+}(\text{aq}) + \text{Zn}^{2+}(\text{aq}) \checkmark$ 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)

8.3

OPTION 1/OPSIE 1

$$E_{\text{cell}}^{\theta} = E_{\text{reduction}}^{\theta} - E_{\text{oxidation}}^{\theta} \checkmark$$

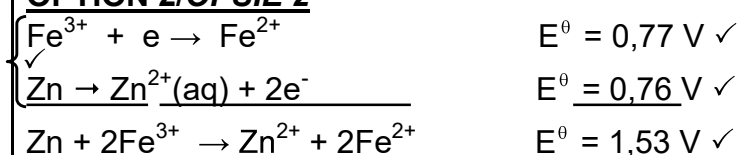
$$= 0,77 \checkmark - (-0,76) \checkmark$$

$$= 1,53 \text{ V} \checkmark$$

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. $E_{\text{cell}}^{\theta} = E_{\text{OA}}^{\theta} - E_{\text{RA}}^{\theta}$ 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: $\frac{3}{4}$

OPTION 2/OPSIE 2



(4)

8.4 Decreases/Verlaag ✓ (1)

[14]

QUESTION 9/VRAAG 9

9.1

Marking criteria/Nasienkriteria

If any one of the underlined key phrases in the **correct context** is omitted, deduct 1 mark./Indien enige van die onderstreepte frases in die **korrekte konteks** uitgelaat is, trek 1 punt af.

ANY ONE/ENIGE EEN:

- The chemical process in which electrical energy is converted to chemical energy. ✓✓
Die chemiese proses waarin elektriese energie omgeskakel word na chemiese energie.
- The use of electrical energy to produce a chemical change.
Die gebruik van elektriese energie om 'n chemiese verandering te weeg te bring.
- Decomposition of an ionic compound by means of electrical energy.
Ontbinding van 'n ioniese verbinding met behulp van elektriese energie.
- The process during which an electric current passes through a solution/ionic liquid/molten ionic compound.
Die proses waardeur 'n elektriese stroom deur 'n oplossing/ioniese vloeistof/gesmelte ioniese verbinding beweeg.

(2)

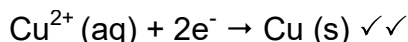
9.2

Copper(II) ions/ Cu^{2+} /koper(II)-ione ✓

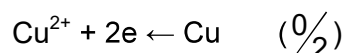
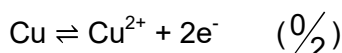
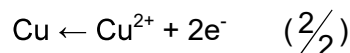
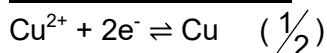
Zinc(II) ions/ Zn^{2+} /sink(II)-ione ✓

(2)

9.3



Notes/Aantekeninge



- Ignore if charge omitted on electron./Ignoreer indien lading weggelaat op elektron.
- If charge (+) omitted on Cu^{2+} /Indien lading (+) weggelaat op Cu^{2+} Max./Maks: $\frac{1}{2}$ Example/Voorbeeld: $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$
- Ignore phases. / Ignoreer fases.

(2)

9.4

Zn^{2+} is a weaker oxidising agent ✓ than Cu^{2+} ✓ and will not be reduced to Zn. ✓

Zn^{2+} is 'n swakker oksideermiddel as Cu^{2+} en sal nie na Zn gereduseer word nie.

(3)

9.5

$$\begin{aligned} n(\text{Cu}) &= \frac{1}{2}n_{\text{electrons/elektrone}} \\ &= \frac{1}{2}(0,6) \quad \checkmark \\ &= 0,3 \text{ mol} \end{aligned}$$

$$\begin{aligned} m &= nM \\ &= 0,3 \times 63,5 \quad \checkmark \\ &= 19,05 \text{ g} \quad \checkmark \end{aligned}$$

Marking criteria/Nasienkriteria

- Use mol ratio/Gebruik molverhouding:
 $n(\text{Cu}) : n(\text{electrons}) = 1 : 2$. ✓
- Substitute/Vervang $63,5 \text{ g} \cdot \text{mol}^{-1}$ in $m = nM$ ✓
- Final answer/Finale antwoord: $19,05 \text{ g}$ ✓

(3)

[12]

QUESTION 10/VRAAG 10

10.1

10.1.1 Nitrogen/N₂/Stikstof ✓ (1)

10.1.2 Iron/Iron(II) oxide/Fe/FeO/yster/yster(II)oksied ✓ (1)

10.1.3 Ammonia/NH₃/ammoniak ✓ (1)

10.1.4 (Fractional) distillation (of liquid air) ✓
(Fraksionele) distillasie (van vloeibare lug) (1)

10.1.5 $2\text{NH}_3 + \text{H}_2\text{SO}_4 \rightarrow (\text{NH}_4)_2\text{SO}_4$ ✓ 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)

10.2

Marking criteria/Nasienkriteria

- Calculate/Bereken m(N,P,K). ✓
- Determine/Bepaal m(x). ✓
- Final answer/Finale antwoord: 3 : 6 : 5 ✓

OPTION 1/OPSIE 1

$$\%(\text{N, P, K}) = 35\%$$

$$m(\text{N,P,K}) = \frac{35}{100} \times 40 \quad \checkmark$$

$$= 14 \text{ kg}$$

$$m(\text{N} + \text{P} + \text{K}) = 5 + x + 2x \quad \checkmark$$

$$= 14$$

$$x = 3 \text{ kg}$$

$$\text{N} : \text{P} : \text{K} = 3 : 6 : 5 \quad \checkmark$$

OPTION 2/OPSIE 2

$$\%(\text{N, P, K}) = 35\%$$

$$m(\text{N,P,K}) = \frac{35}{100} \times 40 \quad \checkmark$$

$$= 14 \text{ kg}$$

$$m(\text{N \& P}) = 14 - 5 = 9 \text{ kg} \quad \checkmark$$

$$x = \frac{1}{3} \times 9 = 3 \text{ kg}$$

$$2x = 6 \text{ kg}$$

$$\text{N} : \text{P} : \text{K} = 3 : 6 : 5 \quad \checkmark$$

(3)

[10]

TOTAL/TOTAAL:

150