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basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

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

GRADE/GRAAD 12

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

NOVEMBER 2020

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

**These marking guidelines consist of 17 pages./
Hierdie nasienriglyne bestaan uit 17 bladsye.**

QUESTION 1/VRAAG 1

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

QUESTION 2/VRAAG 2

2.1.1 Ketones/Ketone ✓ (1)

2.1.2 Pentanal/Pentanaal ✓✓

ACCEPT/AANVAAR

2,2-dimethylpropanal/2,2-dimethylpropanaal

2-methylbutanal/2-metielbutanaal

3-methylbutanal/3-metielbutanaal

Marking criteria/Nasienriglyne

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

(2)

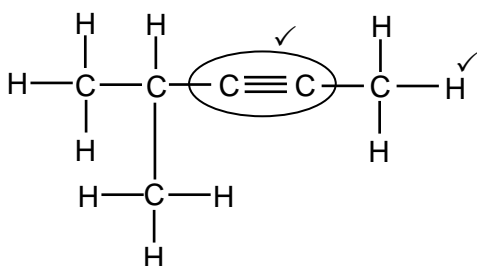
2.2.1 5 – bromo-2,3 – dimethylhexane/5 – bromo-2,3 – dimetielheksaan

Marking criteria/Nasienriglyne:

- Correct stem i.e. hexane./Korrekte stam d.i. heksaan. ✓
- All substituents (bromo and dimethyl) correctly identified./Alle substituenten (bromo en dimetiel) korrek geïdentifiseer. ✓
- IUPAC name completely correct including numbering, sequence, hyphens and commas./IUPAC-naam heeltemal korrek insluitende volgorde, koppeltekens en kommas. ✓

(3)

2.2.2

**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/INDIENMore than one functional group/Meer as een funksionele groep $\frac{0}{2}$

(2)

IF/INDIENMolecular formula/Molekulêre formule $\frac{0}{2}$ Condensed structural formula /Gekondenseerde struktuurformule $\frac{1}{2}$

- 2.3.1 The C atom bonded to the hydroxyl group is bonded to only one other C-atom. ✓✓ **(2 or 0)**
Die C-atoom wat aan die hidroksielgroep gebind is, is aan slegs een ander C-atoom gebind. (2 or 0)

OR/OF

The hydroxyl group/-OH/ is bonded to a C atom which is bonded to two hydrogens atoms. **(2 or 0)**

Die hidroksielgroep/funksionele groep is gebind aan 'n C-atoom wat aan twee waterstofatome gebind is. (2 of 0)

OR/OF

The hydroxyl group/functional group/-OH is bonded to:
 a primary C atom / the first C atom **(2 or 0)**

*Die hidroksielgroep/funksionele groep/-OH aan
 'n primêre C-atoom gebind / die eerste C-atoom gebind (2 of 0)*

OR/OF

The functional group $\begin{array}{c} | \\ -C- \\ | \end{array} OH$ is bonded to only one other C-atom.

Die funksionele groep $\begin{array}{c} | \\ -C- \\ | \end{array} OH$ is aan slegs een ander C-atoom gebind.

(2)

- 2.3.2 Esterification/condensation ✓
Verestering/esterifikasie/kondensasie

(1)

- 2.3.3 Butanoic acid/Butanoësuur ✓

(1)

[12]

QUESTION 3/VRAAG 3

3.1

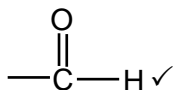
Marking criteria/Nasienriglyne

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.

The temperature at which the vapour pressure equals atmospheric (external) pressure. ✓✓

Die temperatuur waar die dampdruk gelyk is aan atmosferiese (eksterne) druk. (2)

3.2



(1)

3.3

- Increase in the number of C-atoms increases molecular mass/size/chain length/surface area. ✓
- Strength of the intermolecular forces increases/More sites for London forces. ✓
- More energy is needed to overcome/break intermolecular forces. ✓

- Toename in aantal C-atome verhoog molekulêre massa/molekulêre grootte/kettinglengte/reaksie-oppervlak.
- Sterkte van die intermolekulêre kragte verhoog/Meer punte vir Londonkragte.
- Meer energie benodig om intermolekulêre kragte te oorkom/breek. (3)

3.4.1

C ✓

(1)

3.4.2

B ✓

Marking criteria/Nasienriglyne

- Compare strength of intermolecular forces of A, B and C. ✓
- Compare boiling points/energy required to overcome intermolecular forces of alcohols/A and aldehydes/B. ✓

OR

Alcohols have the highest boiling point.

- Compare boiling points/energy required to overcome intermolecular force of aldehydes/B and alkanes/C. ✓

OR

Alkanes have the lowest boiling point.

- Vergelyk sterkte van intermolekulêre kragte van A, B en C. ✓
- Vergelyk kookpunte /energie benodig om intermolekulêre kragte van alkohole/A en aldehyede/B te oorkom. ✓

OF

Alkohole het die hoogste kookpunt.

- Vergelyk kookpunte /energie benodig om intermolekulêre kragte van aldehyede/B en alkane/C. ✓

OF

Alkane het die laagste kookpunt.

Aldehydes/B have (in addition to London forces) dipole-dipole forces which are stronger than London forces, but weaker than hydrogen bonds. ✓
 Therefore aldehydes/B have lower boiling points/require less energy to overcome intermolecular forces than alcohols/A, ✓ but higher boiling points / require more energy to overcome intermolecular forces than alkanes/C. ✓

Aldehyede/B het (in toevoeging tot Londonkragte) dipool-dipoolkragte wat sterker is as Londonkragte, maar swakker is as waterstofbinding.
 Dus het aldehyede/B laer kookpunte/benodig minder energie om intermolekulêre kragte te oorkom as alkohole/A, maar hoër kookpunte/benodig meer energie om intermolekulêre kragte te oorkom as alkane/C.

OR/OF

Aldehydes/B have stronger intermolecular forces than alkanes, but weaker intermolecular forces than alcohols/A. ✓

Therefore aldehydes/B have higher boiling points/ more energy required to overcome intermolecular forces than alkanes/C, ✓ but lower boiling points/ less energy to overcome intermolecular forces than alcohols/A. ✓

Aldehyede/B het sterker intermolekulêre kragte as alkane/C, maar swakker intermolekulêre kragte as alkohole/A.

Dus het aldehyede/B laer kookpunte/ benodig minder energie om intermolekulêre kragte te oorkom as alkohole/A, maar hoër kookpunte/ benodig meer energie om intermolekulêre kragte te oorkom as alkane/C.

(4)

- 3.5 Butanal ✓✓
 Butanaal

Marking criteria/Nasienriglyne

- Correct stem, i.e. but/Korrekte stam d.i. but ✓
- Whole name correct/Hele naam korrek ✓

(2)

- 3.6 Pentan-1-ol ✓✓
OR/OF
 1-pentanol ✓✓

(2)

[15]**QUESTION 4/VRAAG 4**

- 4.1

Marking criteria/Nasienriglyne

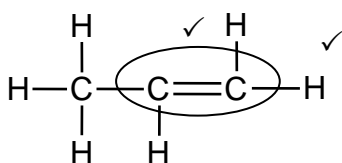
- Addition reaction / reaction of alkene / reaction of C – C double bond /reaction of unsaturated hydrocarbon✓
 Addisie reaksie / reaksie van 'n alkeen /reaksie van C – C dubbelbinding/reaksie van 'n onversadigde koolwaterstof.
- (Addition of) hydrogen halide/HX/ hydrogen and halide. ✓
 (Addisie van) waterstofhalied/HX/waterstof en halied.

The addition ✓ of a hydrogen halide/HX ✓ to an alkene.

Die addisie van 'n waterstofhalied/HX aan 'n alkeen.

(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: $\frac{1}{2}$

(2)

4.3.1 Cracking/Kraking ✓

(1)

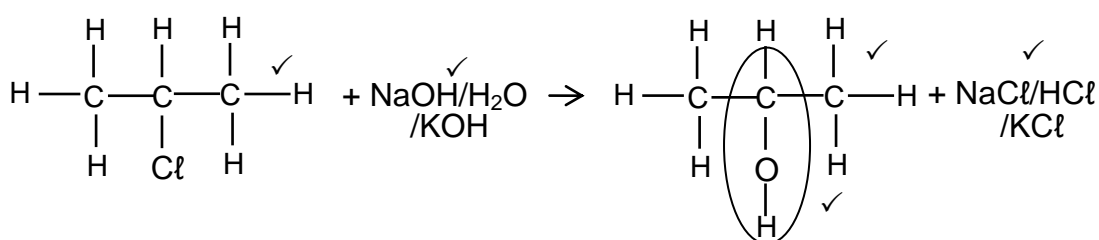
4.3.2 C_8H_{18} ✓

(1)

4.4 1,2-dibromo ✓ propane ✓1,2-dibromopropaan/1,2-dibroompropaan

(2)

4.5.1

**Marking criteria for the alcohol/Nasienriglyne vir die alkohol**

- Whole structure of alcohol correct/Hele struktuur van alkohol korrek: $\frac{2}{2}$
- Only functional group correct/Slegs funksionele groep korrek: $\frac{1}{2}$

Notes/Aantekeninge:

- If 1-chloropropane used as reactant, 2 marks for the primary alcohol.
Indien 1-chloropropaan as reaktanse gebruik is, 2 punte vir die primêre alkohol.
- Condensed or semi-structural formula: Max. $\frac{4}{5}$
Gekondenseerde of semistruktuurformule: Maks. $\frac{4}{5}$
- Molecular formula/Molekulêre formule: $\frac{2}{5}$
- Any additional reactants or products: Max. $\frac{4}{5}$
Enige addisionele reaktanse of produkte: Maks. $\frac{4}{5}$
- If arrow in completely correct equation omitted: Max. $\frac{4}{5}$
Indien pyltjie in volledige korrekte vergelyking uitgelaat is: Maks. $\frac{4}{5}$
- The product $NaCl/KCl/HCl$ must be marked in conjunction with reactant $NaOH/KOH/H_2O$.
Die produk $NaCl/KCl/HCl$ moet in samehang met die reaktans $NaOH/KOH / H_2O$ nagesien word.

(5)

4.5.2 • (Mild) heat/(Matige) hitte ✓

- Dilute strong base/ $NaOH/LiOH/KOH$ **OR** water/ H_2O ✓
Verdunde sterk basis/ $NaOH/LiOH/KOH$ **OF** water/ H_2O

(2)

[15]

QUESTION 5/VRAAG 5

- 5.1.1 (Reaction) rate/Reaksietempo ✓ (1)
- 5.1.2 Surface area/state of division /particle size ✓
Reaksie-oppervlak/toestand van verdeeldheid/deeltjie grootte (1)
- 5.2.1 (Decreasing gradient indicates) rate of reaction is decreasing. ✓
(Afnemende gradiënt dui aan dat) reaksietempo afneem. (1)
- 5.2.2 (Gradient is zero, indicates) reaction rate is zero ✓
(Gradiënt is nul, wat aandui dat) reaksietempo nul is. (1)
- 5.3
ave rate/gem tempo = $\frac{\Delta V}{\Delta t}$
= $\frac{500 \checkmark (-0)}{60 \checkmark (-0)} = 8,33 \text{ (cm}^3 \cdot \text{s}^{-1}) \checkmark$ (3)
- 5.4 Equal to/Gelyk aan ✓ (1)
- 5.5 Greater than/Groter as ✓

Experiment C/Eksperiment C:

- Surface area of CaCO₃ powder is greater than that of CaCO₃ granules./ More particles are exposed /More particles with correct orientation ✓
- More effective collisions per unit time/Higher frequency of effective collisions. ✓
- Increase in reaction rate. ✓
- Reaksieoppervlak van CaCO₃-poeier is groter (as die van CaCO₃-korrels /Meer deeltjies met korrekte oriëntasie.
- Meer effektiewe botsings per eenheid tyd./Hoër frekwensie van effektiewe botsings
- Toename in reaksie tempo

OR/OF**Experiment A/Eksperiment A:**

- Surface area of CaCO₃ granules is smaller/Fewer particles are exposed (than that of powdered CaCO₃). Less particles with correct orientation ✓
- Less effective collisions per unit time./Lower frequency of effective collisions. ✓
- Decrease in reaction rate. ✓.
- Reaksieoppervlak van CaCO₃ is kleiner/Minder deeltjies is blootgestel (as die van die verpoeierde CaCO₃)./ Minder deeltjies met korrekte oriëntasie
- Minder effektiewe botsings per eenheidtyd./Laer frekwensie van effektiewe botsings.
- Afname in reaksie tempo (4)

5.6

Marking criteria/Nasienriglyne:

- Divide volume by 25,7 in / Deel volume deur 25,7 in $n = \frac{V}{V_M}$. ✓

If no substitution step shown, award mark for answer: 0,0195 mol

Indien geen vervanging stap getoon is nie, ken punt toe vir antwoord: 0,0195 mol

- Ratio/Verhouding: $n(\text{CO}_2) = n(\text{CaCO}_3)$. ✓
- Substitute/Vervang 100 in $n = \frac{m}{M}$ or in ratio / of in verhouding. ✓
- Final answer/Finale antwoord: 1,95 g to/tot 2 g. ✓

OPTION 1/OPSIE 1

$$n(\text{CO}_2) = \frac{V}{V_m} = \frac{0,5}{25,7} \quad \checkmark$$

$$= 0,0195 \text{ mol}$$

$$n(\text{CaCO}_3) = n(\text{CO}_2) = 0,0195 \text{ mol} \quad \checkmark$$

$$\begin{aligned} m(\text{CaCO}_3) &= nM \\ &= 0,0195(100) \\ &= 1,95 \text{ g} \quad \checkmark \end{aligned}$$

OPTION 2/OPSIE 2

$$25,7 \text{ dm}^3 \dots\dots\dots 1 \text{ mol}$$

$$0,5 \text{ dm}^3 \dots\dots\dots 0,0195 \text{ mol} \quad \checkmark$$

$$100 \text{ g} \quad \checkmark \dots\dots\dots 1 \text{ mol}$$

$$x \dots\dots\dots 0,0195 \text{ mol} \quad \checkmark$$

$$x = m(\text{CaCO}_3) = 1,95 \text{ g} \quad \checkmark$$

OPTION 3/OPSIE 3

$$n(\text{CO}_2) = \frac{V}{V_m} = \frac{0,5}{25,7} \quad \checkmark$$

$$= 0,0195 \text{ mol}$$

$$0,0195 \text{ mol CO}_2 \equiv 0,856 \text{ g CO}_2 \quad \checkmark$$

$$m(\text{CO}_2) \text{ produced} : m(\text{CaCO}_3)$$

$$44 \text{ g} \quad \quad \quad : 100 \text{ g} \quad \checkmark$$

$$0,856 \quad \quad \quad : x$$

$$x = 1,95 \text{ g} \quad \checkmark \text{CaCO}_3$$

(4)
[16]**QUESTION 6/VRAAG 6**

6.1 Products can be converted back to reactants. ✓

Produkke kan omgeskakel word na reaktantse.

OR/OF

Both forward and reverse reactions can take place.

Beide voor-en terugwaartse reaksies kan plaasvind.

OR/OF

A reaction which can take place in both directions.

'n Reaksie wat in beide rigtings kan plaasvind.

(1)

6.2.1 Remains the same/Bly dieselfde ✓

(1)

6.2.2 Increases/Toeneem ✓

(1)

- 6.3
- (When pressure is increased) the reaction that leads to the smaller amount of gas / side with less molecules/number of moles is favoured. ✓
(Wanneer die druk verhoog word,) word die reaksie wat tot die kleiner hoeveelheid gas /minder gas molekule/aantal mol lei, bevoordeel.

- The reverse reaction is favoured. ✓
Die terugwaartse reaksie word bevoordeel.

(2)

6.4 Endothermic/Endotermies ✓

- K_c decreases with decrease in temperature. ✓
- Reverse reaction is favoured. / Concentration of reactants increases. / Concentration of products decreases./Yield decreases ✓
- Decrease in temperature favours an exothermic reaction. ✓
- K_c neem af met afname in temperatuur.
- Terugwaartse reaksie word bevoordeel./Konsentrasie van reaktanse neem toe./Konsentrasie van produkte neem af./Opbrengs neem af
- Afname in temperatuur bevoordeel 'n eksotermiese reaksie.

OR/OF

- K_c increases with increase in temperature. ✓
- Forward reaction is favoured. / Concentration of reactants decreases. / Concentration of products increases./Yield increases ✓
- Increase in temperature favours an endothermic reaction. ✓
- K_c neem toename met toename in temperatuur.
- Voorwaartse reaksie word bevoordeel./Konsentrasie van produkte neem toe./Konsentrasie van reaktanse neem af./Opbrengs neem toe
- Toename in temperatuur bevoordeel 'n endotermiese reaksie

(4)

6.5

CALCULATIONS USING NUMBER OF MOLES**Mark allocation**

- Correct K_c expression (formulae in square brackets). ✓
- Substitution of equilibrium concentrations into K_c expression. ✓
- Substitution of K_c value. ✓
- Multiply equilibrium concentrations of I_2 and I by $12,3 \text{ dm}^3$. ✓ (**OPTION 1**)
- Multiply equilibrium concentrations of I by $12,3 \text{ dm}^3$ and divide equilibrium mol of I_2 by $12,3 \text{ dm}^3$. ✓ (**OPTION 2**)
- Change in $n(I) = n(I \text{ at equilibrium})$. ✓
- **USING** ratio/**GEBRUIK** verhouding: $I_2 : I = 1 : 2$ ✓
- Initial $n(I_2) = \text{equilibrium } n(I_2) + \text{change in } n(I_2)$. ✓
- Substitute $254 \text{ g} \cdot \text{mol}^{-1}$ as molar mass for I_2 . ✓
- Final answer: $(26 \text{ g} - 27,94 \text{ g})$. ✓

BEREKENINGE WAT AANTAL MOL GEBRUIK**Puntetoekenning:**

- Korrekte K_c -uitdrukking (formules in vierkanthakies).
- Vervanging van ewewigskonsentrasies in K_c -uitdrukking.
- Vervanging van K_c -waarde. ✓
- Vermenigvuldig ewewigskonsentrasies van I_2 en I met $12,3 \text{ dm}^3$. (**OPSIE 1**)
- Vermenigvuldig ewewigskonsentrasies van I met $12,3 \text{ dm}^3$ en deel ewewigsmol I_2 met $12,3 \text{ dm}^3$ (**OPSIE 2**)
- Verandering in $n(I) = n(I \text{ by ewewig})$
- **GEBRUIK** verhouding: $I_2 : I = 1 : 2$ ✓
- Aanvanklike $n(I_2) = \text{ewewigs } n(I_2) + \text{verandering in } n(I_2)$.
- Vervang $254 \text{ g} \cdot \text{mol}^{-1}$ as molêre massa van I_2 .
- Finale antwoord: $(26 \text{ g} - 27,94 \text{ g})$

OPTION 1/OPSIE 1

$$K_c = \frac{[I]^2}{[I_2]} \checkmark$$

$$3,76 \times 10^{-3} = \frac{(4,79 \times 10^{-3})^2}{[I_2]} \checkmark$$

$$\therefore [I_2] = 6,102 \times 10^{-3} \text{ mol} \cdot \text{dm}^{-3}$$

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. $\frac{6}{9}$

	I_2	I	
Initial mass (g) <i>Aanvangsmassa (g)</i>	$(0,1045)(254) \checkmark$ $= 26,543 \text{ g} \checkmark$		
Initial quantity (mol) <i>Aanvangshoeveelheid (mol)</i>	0,1045	0	
Change (mol) <i>Verandering (mol)</i>	\checkmark 0,0295	0,0589 \checkmark	Using ratio \checkmark
Quantity at equilibrium (mol)/ <i>Hoeveelheid by ewewig (mol)</i>	0,0751	0,0589	
Equilibrium concentration ($\text{mol} \cdot \text{dm}^{-3}$) <i>Ewewigskonsentrasie ($\text{mol} \cdot \text{dm}^{-3}$)</i>	$6,102 \times 10^{-3}$	$4,79 \times 10^{-3}$	$\times 12,3 \checkmark$

OPTION 2/OPSIE 2

	I_2	I	
Initial amount (moles) <i>Aanvangshoeveelheid (mol)</i>	x	0	
Change in amount (moles) <i>Verandering in hoeveelheid (mol)</i>	0,0295 \checkmark	0,0589	ratio \checkmark verhouding
Equilibrium amount (moles) <i>hoeveelheid (mol)</i>	$x - 0,0295$	0,0589 \checkmark	
Equilibrium concentration ($\text{mol} \cdot \text{dm}^{-3}$) <i>Ewewigskonsentrasie ($\text{mol} \cdot \text{dm}^{-3}$)</i>	$\frac{x - 0,0295}{12,3}$	$4,79 \times 10^{-3}$	$\times 12,3$ and divide by 12,3 \checkmark

$$K_c = \frac{[I]^2}{[I_2]} \checkmark$$

$$3,76 \times 10^{-3} \checkmark = \frac{(4,79 \times 10^{-3})^2}{\frac{x - 0,0295}{12,3}} \checkmark$$

$$x = 0,1045 \text{ mol}$$

$$\begin{aligned} \therefore m &= nM \checkmark \\ &= (0,1045)(254) \\ &= 26,543 \text{ g} \checkmark \end{aligned}$$

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. $\frac{6}{9}$

CALCULATIONS USING CONCENTRATION**Mark allocation**

- Correct K_c expression (formulae in square brackets). ✓
- Substitution of equilibrium concentrations into K_c expression. ✓
- Substitution of K_c value ✓
- Change in $n(I) = n(I \text{ at equilibrium})$. ✓
- **USING** ratio: $I_2 : I = 1 : 2$ ✓
- Initial $[I_2] = \text{equilibrium } [I_2] + \text{change in } [I_2]$. ✓
- Divide by $12,3 \text{ dm}^3$. ✓
- Substitute $254 \text{ g} \cdot \text{mol}^{-1}$ as molar mass for I_2 . ✓
- Final answer $26,543 \text{ g}$. ✓

BEREKENINGE WAT KONSENTRASIE GEBRUIK**Puntetoekenning**

- Korrekte K_c -uitdrukking (formules in vierkanthakies).
- Vervanging van ewewigskonsentrasies in K_c -uitdrukking.
- Vervanging van K_c -waarde.
- Verandering in $n(I) = n(I \text{ by ewewig})$.
- **GEBRUIK** verhouding $I_2 : I = 1 : 2$
- Aanvanklike $[I_2] = \text{ewewigs } [I_2] + \text{verandering in } [I_2]$.
- Deel deur $12,3 \text{ dm}^3$. ✓
- Vervang $254 \text{ g} \cdot \text{mol}^{-1}$ as molêre massa van I_2 .
- Finale antwoord: $26,543 \text{ g}$

OPTION 3/OPSIE 3

$$K_c = \frac{[I]^2}{[I_2]} \quad \checkmark$$

$$3,76 \times 10^{-3} \checkmark = \frac{(4,79 \times 10^{-3})^2}{[I_2]} \quad \checkmark$$

$$[I_2] = 6,102 \times 10^{-3} \text{ mol} \cdot \text{dm}^{-3}$$

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. $\frac{6}{9}$

	I_2	I
Initial concentration ($\text{mol} \cdot \text{dm}^{-3}$) <i>Aanvangskonsentrasie ($\text{mol} \cdot \text{dm}^{-3}$)</i>	$8,497 \times 10^{-3}$	0
Change ($\text{mol} \cdot \text{dm}^{-3}$) <i>Verandering ($\text{mol} \cdot \text{dm}^{-3}$)</i>	$2,395 \times 10^{-3}$	$4,79 \times 10^{-3} \checkmark$
Equilibrium concentration ($\text{mol} \cdot \text{dm}^{-3}$) <i>Ewewigskonsentrasie ($\text{mol} \cdot \text{dm}^{-3}$)</i>	$6,102 \times 10^{-3}$	$4,79 \times 10^{-3}$

Using ratio ✓

$$c = \frac{m}{MV}$$

$$8,497 \times 10^{-3} = \frac{m}{(254) \checkmark (12,3) \checkmark}$$

$$\therefore m = 26,546 \text{ g}$$

(9)
[18]

QUESTION 7/VRAAG 7

7.1.1 Weak/Swak ✓



Ionises/Dissociates incompletely/partially (in water) ✓
Ioniseer/Dissosieer/onvolledig/gedeeltelik (in water)

(2)

7.1.2

OPTION 1/OPSIE 1

$\text{pH} = -\log[\text{H}_3\text{O}^+]$ ✓
 $3,85$ ✓ $= -\log[\text{H}_3\text{O}^+]$
 $[\text{H}_3\text{O}^+] = 1,41 \times 10^{-4} \text{ mol} \cdot \text{dm}^{-3}$ ✓

OPTION 2/OPSIE 2

$[\text{H}_3\text{O}^+] = 10^{-\text{pH}}$ ✓
 $= 10^{-3,85}$ ✓
 $= 1,41 \times 10^{-4} \text{ mol} \cdot \text{dm}^{-3}$ ✓

(3)

7.1.3 Greater than/Groter as ✓

(1)

7.1.4 $\text{CH}_3\text{COO}^-(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{COOH}(\text{aq}) + \text{OH}^-(\text{aq})$ ✓**OR/OF** $\text{CH}_3\text{COONa}(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{CH}_3\text{COOH}(\text{aq}) + \text{NaOH}(\text{aq})$ ✓Due to formation of hydroxide/ OH^- / the solution is basic/alkaline / $\text{pH} > 7$. ✓

*As gevolg van die vorming van hidroksied/ OH^- is die oplossing basies/
 alkalies / $\text{pH} > 7$*

(3)

7.2.1

Marking criteria/Nasienriglyne

- Substitute/vervang: $1 \times 0,0145$ **OR/OF** $1 \times 14,5$ in $c = \frac{n}{V} / \frac{c_a \times V_a}{c_b \times V_b} = \frac{n_a}{n_b}$. ✓
- Use/Gebruik: $n(\text{CH}_3\text{COOH}) : n(\text{NaOH}) = 1:1$ ✓
- Final answer/Finale antwoord: $0,0145 \text{ mol}$ ✓

OPTION 1/OPSIE 1

$n(\text{NaOH})_{\text{reacted}} = cV$
 $= 1(0,0145)$ ✓
 $= 0,0145 \text{ mol}$

$n(\text{CH}_3\text{COOH})_{\text{diluted}} = n(\text{NaOH})$ ✓
 $= 0,0145 \text{ mol}$ ✓

(3)

7.2.2 **POSITIVE MARKING FROM 7.2.1./POSITIEWE NASIEN VANAF VRAAG 7.2.1.****Marking criteria/Nasienriglyne**

- Calculate mass/Bereken massa CH_3COOH in 25 cm^3 (1,13 g). ✓
- Formula/Formule: $n = \frac{m}{M}$. ✓
- Substitute/Vervang: $M = 60 \text{ g} \cdot \text{mol}^{-1}$. ✓
- $n(\text{CH}_3\text{COOH})_{\text{reacted/reageer}} = n_{\text{initial/begin}} - n_{\text{unreacted/nie reageer}}$ ✓
- USE mol ratio/GEBRUIK molverhouding: $n(\text{CaCO}_3) : n(\text{CH}_3\text{COOH}) = 1 : 2$. ✓
- Substitution of/Vervanging van $100 \text{ g} \cdot \text{mol}^{-1}$ in $m = nM$. ✓
- Calculate percentage/Bereken persentasie: $\frac{0,217}{1,2} \times 100$ ✓
- Final answer/Finale antwoord: 18,08% ✓ (17,92 – 22,92)

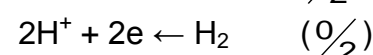
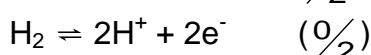
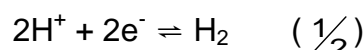
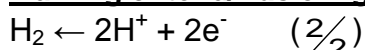
$$\begin{aligned}
 m(\text{CH}_3\text{COOH}) &= \frac{4,52}{100} \times 25 \checkmark = 1,13 \text{ g} \\
 n(\text{CH}_3\text{COOH})_{\text{ini/aanv.}} &= \frac{m}{M} \checkmark \\
 &= \frac{1,13}{60} \checkmark = 0,01883 \text{ mol} \\
 n(\text{CH}_3\text{COOH})_{\text{rea}} &= 0,01883 \checkmark - 0,0145 = 0,0043 \text{ mol} \\
 n(\text{CaCO}_3) &= \frac{1}{2} n(\text{CH}_3\text{COOH}) \\
 &= 0,5(0,0043) \checkmark \\
 &= 0,00217 \text{ mol} \\
 m(\text{CaCO}_3) &= nM \downarrow \checkmark \\
 &= 0,00217(100) = 0,217 \text{ g} \\
 \% \text{ CaCO}_3 &= \frac{0,217}{1,2} \times 100 \checkmark \\
 &= 18,08 \% \checkmark
 \end{aligned}$$

(8)
[20]

QUESTION 8/VRAAG 8

- 8.1 Provides path for movement of ions./Ensures(electrical)neutrality in the cell. ✓
Verskaf pad vir beweging van ione./Verseker (elektriese) neutraliteit in die sel. (1)
- 8.2 (The electrode) where oxidation takes place/electrons are lost. ✓✓
(Die elektrode) waar oksidasie plaasvind/elektrone verloor word. (2)
- 8.3 Mg/Magnesium ✓ (1)
- 8.4.1 $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$ ✓✓

Marking criteria/Nasienriglyne



- Ignore if charge omitted on electron./Ignoreer indien lading weggelaat op elektron.

- If charge (+) omitted on H^+ /Indien lading (+) weggelaat op H^+ :

Example/Voorbeeld: $2\text{H} + 2\text{e}^- \rightarrow \text{H}_2$ ✓

Max./Maks: $1/2$

(2)

- 8.4.2 Magnesium/Mg ✓ (1)

8.5

OPTION 1/OPSIE 1

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

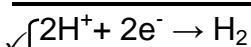
$$= 0 \checkmark - (-2,36) \checkmark$$

$$E_{\text{cell}}^{\theta} = 2,36 \text{ V} \checkmark$$

Notes/Aantekeninge

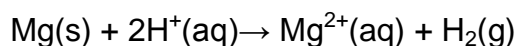
- Accept any other correct formula from the data sheet./Aanvaar enige ander korrekte formule vanaf gegewensblad.
- Any other formula using unconventional abbreviations, e.g. $E_{\text{cell}}^{\theta} = E_{\text{OA}}^{\theta} - E_{\text{RA}}^{\theta}$ followed by correct substitutions:/Enige ander formule wat onkonvensionele afkortings gebruik bv. $E_{\text{sel}}^{\theta} = E_{\text{OM}}^{\theta} - E_{\text{RM}}^{\theta}$ gevolg deur korrekte vervangings: $3/4$

OPTION 2/OPSIE 2



$$E^{\theta} = 0 \text{ V} \checkmark$$

$$E^{\theta} = +2,36 \text{ V} \checkmark$$



$$E^{\theta} = +2,36 \text{ V} \checkmark$$

(4)

- 8.6 H_2 is a stronger reducing agent ✓ than Cu ✓ and therefore Cu^{2+}/Cu ions are reduced/ H_2 is oxidised ✓ Electrons flow from H_2 to Cu.

H_2 is 'n sterker reduseermiddel as Cu en dus word Cu^{2+}/Cu -ione gereduseer/ H_2 is geoksideer. Elektrone vloei vanaf H_2 na Cu.

(3)

[14]

QUESTION 9/VRAAG 9**9.1 ANY ONE/ENIGE EEN:**

- The chemical process in which electrical energy is converted to chemical energy. ✓✓ **(2 or 0)**
- The use of electrical energy to produce a chemical change. **(2 or 0)**
- Decomposition of an ionic compound by means of electrical energy. **(2 or 0)**
- The process during which and electric current passes through a solution/ionic liquid/molten ionic compound. **(2 or 0)**
- *Die chemiese proses waarin elektriese energie omgeskakel word na chemiese energie. **(2 of 0)***
- *Die gebruik van elektriese energie om 'n chemiese verandering te weeg te bring. **(2 of 0)***
- *Ontbinding van 'n ioniese verbinding met behulp van elektriese energie. **(2 of 0)***
- *Die proses waardeur 'n elektriese stroom deur 'n oplossing/ioniese vloeistof/gesmelte ioniese verbinding beweeg. **(2 of 0)***


(2)

9.2 Battery/cell/ power source ✓
Battery/sel/kragbron

(1)

9.3 Silver nitrate/AgNO₃/ Silver ethanoate/CH₃COOAg / Silver fluoride /AgF/
Silver perchlorate AgClO₄. ✓
Silwernitraat/AgNO₃/ Silweretanoaat/CH₃COOAg / Silwerfloried / AgF /
Silwerperchloraat / AgClO₄

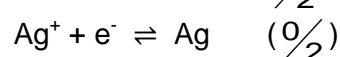
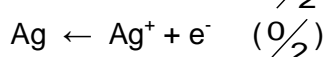
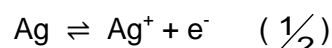
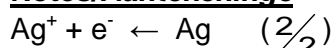
(1)

9.4  Remains the same/Bly dieselfde ✓

Rate of oxidation is equal to the rate of reduction. ✓
Tempo van oksidasie is gelyk aan die tempo van reduksie.

(2)

9.5 $\text{Ag} \rightarrow \text{Ag}^+ + \text{e}^-$ ✓✓

Notes/Aantekeninge

- Ignore if charge omitted on electron./Ignoreer indien lading weggelaat op elektron.

- If charge (+) omitted on Ag⁺/Indien lading (+) weggelaat op Ag⁺:

Example/Voorbeeld: $\text{Ag} \rightarrow \text{Ag} + \text{e}^-$ ✓

(2)

[8]

QUESTION 10/VRAAG 10

- 10.1.1 (Liquid) Air/(Vloeibare)Lug ✓ (1)
- 10.1.2 Natural gas/methane/oil/coal/coke✓
Aardgas/metaan/olie/steenkool/kooks (1)
- 10.1.3 Iron/iron oxide/Fe/FeO ✓
Yster/ysteroksied/Fe/FeO (1)
- 10.1.4 NH₃/Ammonia/Ammoniak ✓ (1)
- 10.1.5 Ostwald (process)/Ostwald(proses) ✓ (1)
- 10.1.6 NH₃ + HNO₃ ✓ → NH₄NO₃ ✓ Bal ✓

Marking criteria/Nasienriglyne

- Reactants ✓ Products ✓ Balancing ✓
Reaktanse Produkte Balansering
- Ignore double arrows./Ignoreer dubbelpyle.
- Marking rule 6.3.10./Nasienreël 6.3.10.

(3)

- 10.2.1 NPK ratio/Ratio of primary nutrients ✓
NPK-verhouding/Verhouding van primêre voedingstowwe (1)

- 10.2.2
- | OPTION 1/OPSIE 1 | OPTION 2/OPSIE 2 |
|---|---|
| $\frac{4}{9} \times \frac{X}{100} \times 20 = 2,315 \text{ kg}$ <p>X = 26 ✓ (26,04)</p> | <p>m(P) = 2,315 kg</p> <p>Mass of 1 part P = $\frac{2,315}{4} = 0,57575$</p> <p>Mass of N = (0,57575)(2) = 1,1575 kg</p> <p>Mass of K = (0,57575)(3) = 1,73625 kg</p> <p>Total mass of fertiliser:
1,1575 + 2,315 + 1,73625 = 5,20875 kg ✓</p> <p>X = $\frac{5,20875}{20} \times 100 = 26,04$ ✓</p> |

(3)

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