Province of the
EASTERN CAPE
EDUCATION

# NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIOR SERTIFIKAAT*

## GRADE/*GRAAD* 12




## PHY… 2
## MARKING GUIDELINE/ *FISIESE WETENSKAPPE V2 NASIENRIGLYN*

**MARKS/ *PUNTE*:** **150**

This marking guideline consists of 19 pages./
*Hierdie nasienriglyn bestaan uit 19 bladsye.*

## QUESTION/*VRAAG* 1

1.1 B ✓✓ (2)

1.2 A ✓✓ (2)

1.3 B ✓✓ (2)

1.4 C ✓✓ (2)

1.5 C ✓✓ (2)

1.6 A ✓✓ (2)

1.7 B ✓✓ (2)

1.8 D ✓✓ (2)

1.9 B ✓✓ (2)

1.10 A ✓✓ (2)

**[20]**

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## QUESTION/*VRAAG* 2

2.1 It is a series of organic compounds that can be described by the same general formula. ✓✓ **(2 or 0)**

*'n Reeks organiese verbindings wat deur dieselfde algemene formule beskryf kan word.* ***(2 of 0)***

**OR/*OF***

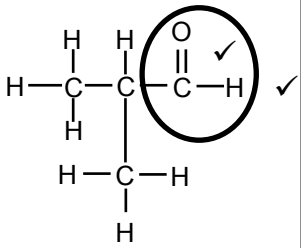
A series/group of organic compounds in which one member differs from the next with -$CH_2$- group. ✓✓ **(2 or 0)**

*'n Reeks organiese verbindings waarin die een lid van die volgende verskil met 'n $CH_2$-groep*. (2)

2.2.1 D ✓ (1)

2.2.2 $C_nH_{2n-2}$ ✓ (1)

2.2.3



✓ ✓

***Marking criteria/ Nasienkriteria***

- Only functional group correct / *Slegs funksionele groep korrek*: Max/ *Maks ½*
- *Whole structure correct/ Hele struktuur korrek: 2/2*

(2)

2.3 3-ethyl-2-methylhexanoic acid / *3-etiel-2-metielheksanoësuur*

**Marking criteria**

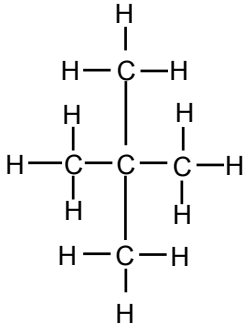
- Correct stem i.e hexanoic acid ✓
- All substituents (ethyl and methyl) correctly identified ✓
- IUPAC name completely correct including numbering, sequence and hyphens ✓

***Nasienkriteria***

- *Korrekte stam d.i heksanoësuur*
- *Alle substituente (etiel en metiel) korrek geïdentifiseer*
- *IUPAC-naam heeltemal korrek insluitende nommering, volgorde en koppeltekens*

(3)

2.4.1



**Marking criteria/*Nasienkriteria***

- Longest chain contains 3 carbons / *Langste koolstofketting bevat 3 koolstowwe* ✓
- Two methyl substituents on C2 / *...metielsubstituente op C2* ✓
- ...structure is correct / *Hele ...ur korrek* ✓




(3)

2.4.2 $C_5H_{12} + 8\ O_2$ ✓→ $6\ H_2O + 5\ CO_2$ ✓ (bal ✓)

**Marking criteria/ *Nasienkriteria***
- Reactants / *Reaktanse*
- Products / *Produkte*
- Balancing / *Balansering*

(3)
**[15]**

**QUESTION/*VRAAG* 3**

3.1.1

**Marking criteria/Nasienkriteria**
If any of the underlined key words/phrases in the **correct context** are omitted: - 1 mark per word/phrase.
*Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: - 1 punt per woord/frase.*

The temperature at which the vapour pressure of a liquid equals the atmospheric pressure. ✓✓

*Die temperatuur waarby die dampdruk van die vloeistof gelyk is aan die atmosferiese druk.* (2)

3.1.2 As the number of C atoms increases:

- The surface area/chain length/molecular mass of the alcohols increases ✓
- The strength of London forces/induced dipole forces/dispersion forces increase. ✓

*Soos die aantal C-atome toeneem:*

- *Die oppervlak-area/kettinglengte/molekulêre massa van die alkohole verhoog.*
- *Die sterkte van die Londonkragte/geïnduseerde dipoolkragte/ verspreidingskragte verhoog*

**OR/*OF***

As the number of C atoms decreases:

- The surface area/chain length/molecular mass of the alcohols decreases ✓
- The strength of London forces/induced dipole forces/dispersion forces decrease. ✓

*Soos die aantal C-atome afneem:*

- *Die oppervlak-area/kettinglengte/molekulêre massa van die alkohole verlaag.*
- *Die sterkte van die Londonkragte/geïnduseerde dipoolkragte/ verspreidingskragte verswak* (2)

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3.1.3 **Marking criteria**
- Identify the intermolecular forces in both compounds. ✓✓
- Compare the strength of the intermolecular forces. ✓

***Nasienkriteria***
- *Die intermolekulêre kragte korrek geïdentifiseer in beide verbindings*
- *Vergelyk die sterkte van die intermolekulêre kragte*

- Alcohols have both (London forces) and hydrogen bonds ✓
- Ketones have both (London forces) and dipole-dipole forces ✓
- Hydrogen bonds in the alcohols are stronger than the dipole-dipole forces in ketones ✓

- *Alkohole het beide (Londonkragte) en waterstofbindings*
- *Ketone het beide (Londonkragte) en dipool-dipool kragte*
- *Waterstofbindings in die alkohole is sterker as die dipool-dipoolkragte in ketone*

**OR/*OF***

- Alcohols have both (London forces) and hydrogen bonds ✓
- Ketones have both (London forces) and dipole-dipole forces ✓
- the dipole-dipole forces in Ketones are weaker than the hydrogen bonds in the alcohols ✓

- *Alkohole het beide (Londonkragte) en waterstofbindings*
- *Ketone het beide (Londonkragte) en dipool-dippol kragte*
- *Die dipool-dipoolkragte in ketone is swakker as die waterstofbindings in die alkohole* (3)

3.1.4 To have one independent variable✓ **OR** To have a fair test
*Om slegs een onafhanklike veranderlike te het **OF** Om 'n regverdige toets te hê* (1)

3.1.5 Ketone ✓

Lower boiling point / *Laer kookpunt* ✓ (2)

3.2.1 Propanoic acid / *Propanoësuur* ✓ (1)

3.2.2

**Marking criteria**

- Identify the intermolecular forces correctly in both compounds. ✓
- Compare the strength of the intermolecular forces. ✓
- Compare the energy required to overcome the intermolecular forces. ✓

***Nasienkriteria***

- *Die intermolekulêre kragte is korrek in beide verbindings geïdentifiseer*
- *Vergelyk die sterkte van die intermolekulêre kragte.*
- *Vergelyk die energie wat benodig word om die intermolekulêre kragte te oorkom.*

- Both have hydrogen bonds
- Propan-1-ol has ONE site for hydrogen bonds
- Propanoic acid has TWO sites for hydrogen bonds } ✓
- The intermolecular forces of propanoic acid are stronger than that of propan-1-ol ✓
- More energy is needed to overcome the intermolecular forces of propanoic acid. ✓

- *Beide het waterstofbindings*
- *Propan-1-ol het EEN plek vir waterstofbindings*
- *Propanoësuur het TWEE plekke vir waterstofbindings*
- *Die intermolekulêrekragte in propanoësuur is sterker as dié in propan-1-ol*
- *Meer energie word benodig om die intermolekulêre kragte te oorkom in propanoësuur*




**OR/OF**

- Both have hydrogen bonds.
- Propan-1-ol has ONE site for hydrogen bonds
- Propanoic acid has two sites for hydrogen bonds } ✓
- The intermolecular forces of propan-1-ol are weaker than that of propanoic acid ✓
- Less energy is needed to overcome the intermolecular forces of propan-1-ol. ✓

- *Beide het waterstofbindings*
- *Propan-1-ol het EEN plek vir waterstofbindings*
- *Propanoësuur het TWEE plekke vir waterstofbindings*
- *Die intermolekulêrekragte in propan-1-ol is swakker as dié in propanoësuur.*
- *Minder energie word benodig om die intermolekulêre kragte te oorkom in propan-1-ol.*

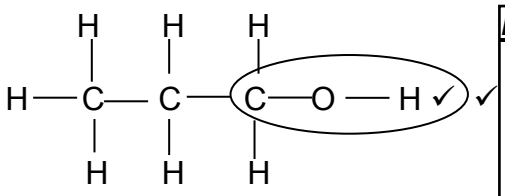
(3)
**[14]**



**QUESTION/*VRAAG 4***

4.1.1 Esterification / condensation / *Esterifikasie / konsensasie*✓ (1)

4.1.2 (Mild) heat */ (Matige) hitte* ✓ (1)

4.1.3 

***Marking criteria/ Nasienkriteria***
- Only functional group correct *Slegs funksionele groep korrek*: Max/*Maks ½*
- *Whole structure correct/ Hele struktuur korrek: 2/2*

(2)

4.1.4 Propyl ✓ethanoate ✓ / *Propiel etanoaat* (2)

4.1.5 Pentanoic acid / *Propanoësuur* ✓✓ (2)

4.1.6 Substitution reaction / *Substitusie-reaksie* ✓ (1)

4.1.7 $H_2O$ ✓ (1)

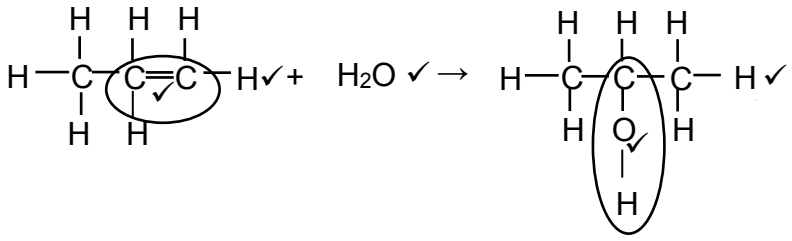
4.1.8 $CH_3CH_2CH_2C\ell$ ✓✓

***Marking criteria/ Nasienkriteria***
- Only functional group correct */ Slegs funksionele groep korrek*: Max/*Maks ½*
- *Whole structure correct / Hele struktuur korrek: 2/2*

(2)

4.2.1 (Concentrated / *Gekonsentreerde*) $H_2SO_4$ ✓ (2)

4.2.2 $H_2O$ in excess ✓ / catalyst/ (Add small amount of $HC\ell/H_3PO_4$) (1)

4.2.3 

***Marking criteria/ Nasienkriteria***
**(Organic molecules / *Organiese molekules*)**
- Only functional group correct */ Slegs funksionele groep korrek*: Max/*Maks ½*
- *Whole structure correct/ Hele struktuur korrek: 2/2*

(5)
**[20]**

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**QUESTION/*VRAAG 5***

5.1

**Marking criteria/ *Nasienkriteria***
If any of the underlined key words/phrases in the **correct context** are omitted: - 1 mark per word/phrase.
*Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: - 1 punt per woord/frase*

**ANY ONE**

- Change in concentration ✓of reactant / product per (unit) time.✓
- Change in amount/number of moles/volume/mass of products or reactants per (unit) time.
- Amount/number of moles/volume/mass of products formed/reactants used reactants per (unit) time.

***ENIGE EEN***

- *Verandering in konsentrasie van reaktanse/produkte per (eenheid) tyd*
- *Verandering in hoeveelheid/getal mol/volume/massa van reaktanse of produkte per (eenheid) tyd.*
- *Hoeveelheid/getal mol/volume/massa van produkte gevorm/ reaktanse gebruik per (eenheid) tyd*

**OR/*OF***

The rate of change in concentration / amount of moles / number of moles / volume / mass. **(2 or 0).**

*Die tempo van verandering in konsentrasie / hoeveelheid mol / getal mol/volume/massa **(2 of 0)*** (2)

5.2 Concentration / *Konsentrasie* (of/*van* HCℓ) ✓ (1)

5.3 Equal to / *Gelyk aan* ✓

The same amount of (the limiting reagent), $Na_2S_2O_3$, is used. ✓
*Dieselfde hoeveelheid (van beperkde reagens) $Na_2S_2O_3$ was gebruik.* (2)

5.4.1 Experiment 3 / *Eksperiment 3* ✓ (1)

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5.4.2 For $T_2$

- Higher temperature increases kinetic energy of particles ✓
- Greater number of particles have sufficient energy. ✓
- More effective collision per unit time ✓

*Vir $T_2$*

- *Hoër temperatuur verhoog die kinetiese energie van die deeltjies*
- *Groter aantal deeltjies het genoeg energie*
- *Meer effektiewe botsings per eenheidstyd*

**OR/*OF***

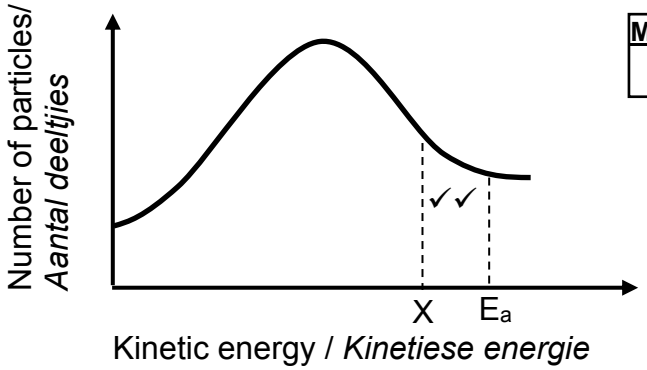
For $T_1$

- Lower temperature decreases kinetic energy of particles
- Fewer particles have sufficient energy.
- Less effective collision per unit time

*Vir $T_1$*

- *Laer temperatuur verlaag die kinetiese energie van die deeltjies*
- *Minder aantal deeltjies het genoeg energie*
- *Minder effektiewe botsings per eenheidstyd* (3)

5.4.3




**Marking criteria/*Nasienkriteria***

- $X < E_a$

(2)

5.5

**Marking criteria**

- Formula n = m/M
- Substitution into n = m/M
- **Using** ratio HCℓ: $Na_2S_2O_3$ 2 : 1
- Substitution into rate equation
- Final answer

***Nasienkriteria***

- *Formule* n = m/M
- *Vervanging in* n = m/M
- ***Gebruik** van verhouding* HCℓ: $Na_2S_2O_3$ 2 : 1
- *Vervanging in tempo vergelyking*
- *Finale antwoord*

$n = \frac{m}{M}$ ✓

$n = \frac{0,7118}{158}$ ✓

n ($Na_2S_2O_3$) = $4,505 \times 10^{-3}$ mol

n (HCℓ) = 2 ($4,505 \times 10^{-3}$) ✓

n (HCℓ) = $9,01 \times 10^{-3}$ mol

rate/ *tempo* = $-\frac{\Delta n}{\Delta t}$

rate/ *tempo* = $-\frac{0 - 9,01 \times 10^{-3}}{34}$ ✓

rate/ *tempo* = $2,65 \times 10^{-4}$ (mol·s$^{-1}$) ✓

**Accept / *Aanvaar***

rate/ *tempo* = $\frac{\Delta n}{\Delta t}$

rate/*tempo* = $\frac{-9,01 \times 10^{-3}}{34}$ ✓

rate / *tempo* = $-2,65 \times 10^{-4}$ (mol·s$^{-1}$) ✓

(5)

5.6 REMAINS THE SAME / *BLY DIESELFDE* ✓ (1)

**[17]**

**QUESTION/*VRAAG 6***

6.1.1 (A reaction in which) products can be converted back to its reactants ✓✓
(and vice versa)

*(Is 'n reaksie waar) produkte terug na reaktanse, en omgekeerd, omgeskakel kan word.* **(2 or/ *of* 0)** (2)

6.1.2 Turns more pink / *Raak meer pienk* ✓ (1)

6.1.3 Turns more blue / *Raak meer blou* ✓ (1)

6.1.4 Exothermic / *Eksotermies* ✓ (1)

6.1.5
- Increase in temperature shifted the equilibrium position left ✓/Reverse reaction is favoured
- Increase in temperature favours the endothermic reaction ✓

- *Toename in temperatuur verskuif die ewewigsposisie na links/ Terugwaartse reaksie word bevoordeel.*
- *Toename in temperatuur bevoordeel 'n endotermiese reaksie.* (2)

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6.2

**OPTION 1: MOLE CALCULATIONS**
***OPSIE 1: MOL BEREKENINGE***

**Marking criteria:**

a. Substitution into formula $n = \frac{N}{N_A}$ ✓
b. Using ratio $N_2O_4 : NO_2 = 1 : 2$ ✓
c. $n(NO_2)$ equilibrium = $n_{initial} + \Delta n$ ✓
d. $n(N_2O_4)$ equilibrium = n initial - $\Delta n$ ✓
e. Divide **equilibrium** amounts of $N_2O_4$ and $NO_2$ by 4 $dm^3$ ✓
f. Correct $K_C$ expression (formulae in square brackets) ✓
g. Substitution into equilibrium concentration into $K_C$ expression ✓
h. Final answer ✓

***Nasienkriteria:***

a. *Vervanging in formule* $n = \frac{N}{N_A}$
b. ***Gebruik*** *verhouding* $N_2O_4 : NO_2 = 1 : 2$ ✓
c. $n(NO_2)$ ewewig = $n_{initial} + \Delta n$ ✓
d. *Deel* ***ewewig****hoeveelhede van* $N_2O_4$ *en* $NO_2$ *deur 4* $dm^3$
e. *Korrekte* $K_c$*-uitdrukking (formules met vierkanthakies)*
f. *Vervanging in ewewigskonsentrasies in* $K_c$*-uitdrukking*
g. *Finale antwoord*

$n = \frac{N}{N_A}$

$n = \frac{3{,}01 \times 10^{23}}{6{,}02 \times 10^{23}}$ ✓ (a)




n = 0,5 mol

| | $N_2O_4$ (g) | 2 $NO_2$ (g) | |
|---|---|---|---|
| Initial quantity (mol)<br>*Aanvangshoeveelheid (mol)* | 0,5 | - | |
| Change (mol)<br>*Verandering (mol)* | 0,4 | 0,8 | ✓ (b) ratio |
| Equilibrium (mol)<br>*Ewewig (mol)* | 0,1 ✓ (d) | 0,8 | ✓ (c) |
| Concentration ($mol \cdot dm^{-3}$)<br>*Konsentrasie (mol·dm$^{-3}$)* | 0,025 | 0,2 | ✓ (e) |

| | |
|---|---|
| $K_c = \frac{[NO_2]^2}{[N_2O_4]}$ ✓ (f) | No $K_c$ expression, correct substitution / *Geen $K_c$-uitdrukking, korrekte, korrekte substitusie.* Max / *Maks 7/8* |
| $K_c = \frac{(0,2)^2}{(0,025)}$ ✓ (g) | Wrong $K_c$ expression/*Verkeerde $K_c$ – uitdrukking.* Max. *Maks. 5/8* |
| $K_c = 1,6$ ✓ (h) | |

**OPTION 2: CONCENTRATION CALCULATIONS/**
***OPSIE 2:* KONSENTRASIEBEREKENINGE**

**Marking criteria**

a. Substitution into formula $n = \frac{N}{N_A}$ ✓
b. Using ratio $N_2O_4$: $NO_2$ = 1 : 2 ✓
c. c($NO_2$) equilibrium = c $_{initial}$ + Δc ✓
d. c($N_2O_4$) equilibrium = c initial – Δc ✓
e. Divide n initial and Δn of $N_2O_4$ by 4 $dm^3$ ✓
f. Correct $K_C$ expression (formulae in square brackets) ✓
g. Substitution into equilibrium concentration into $K_C$ expression ✓
h. Final answer ✓

***Nasienkriteria:***

a. *Vervanging in formule* $n = \frac{N}{N_A}$
*b.* ***Gebruik*** *verhouding $N_2O_4$ : $NO_2$ 1 : 2*
*c. Ewewig* c($NO_2$) = *begin c* + Δc
d. *Ewewig c ($N_2O_4$) = begin c* – Δc ✓(b)
*e. Deel* ***aanvangs en verandering*** *hoeveelhede van $N_2O_4$ en $NO_2$ deur 4 $dm^3$*
*f. Korrekte $K_c$-uitdrukking (formules met vierkanthakies)* ✓ (e)
*g. Vervanging in ewewigskonsentrasies in $K_c$-uitdrukking*
*h. Finale antwoord*

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$n = \frac{N}{N_A}$

$n = \frac{3,01 \times 10^{23}}{6,02 \times 10^{23}}$ ✓ (a)

n = 0,5 mol

| | $N_2O_4$ (g) | 2 $NO_2$ (g) |
|---|---|---|
| Initial concentration (mol·dm$^{-3}$) *Aanvangs konsentrasie (mol·dm$^{-3}$)* | 0,125 ✓ (d) | - |
| Change in concentration (mol·dm$^{-3}$) *Verandering in konsentrasie(mol·dm$^{-3}$)* | 0,1 | 0,2 |
| Equilibrium concentration (mol·dm$^{-3}$) *Ewewig konsentrasie (mol·dm$^{-3}$)* | 0,025✓ (c) | 0,2 |

$K_c = \frac{[NO_2]^2}{[N_2O_4]}$ ✓ (f)

$K_c = \frac{(0,2)^2}{(0,025)}$ ✓ (g)

$K_c = 1,6$ ✓ (h)

| |
|---|
| No $K_c$ expression, correct substitution / *Geen $K_c$-uitdrukking, korrekte substitusie.* Max / *Maks 7/8* |
| Wrong $K_c$ expression / *Verkeerde $K_c$ -uitdrukking.* Max. *Maks. 5/8* |

(8)

**[15]**

**QUESTION/*VRAAG 7***

7.1.1 An acid is a proton ($H^+$ ion) donor / *'n Suur is 'n proton ($H^+$-ioon) skenker* ✓✓ (2)

7.1.2 $HC\ell$ and/*en* $C\ell^-$ ✓✓ **OR/*OF*** $H_3O^+$ and/*en* $H_2O$ ✓✓ (2)

7.1.3 Solution **I.** ✓

- $HC\ell$ is a stronger acid than $CH_3COOH$ / $HC\ell$ has a higher $K_a$ ✓ (than $CH_3COOH$)
- $HC\ell$ will produce a higher concentration of $H_3O^+$ ✓ (than $CH_3COOH$)

OR

- $CH_3COOH$ is a weaker acid than $HC\ell$ / $CH_3COOH$ has a lower $K_a$ (than $HC\ell$)
- $CH_3COOH$ will produce a lower concentration of $H_3O^+$ (than $HC\ell$)

*Oplossing **I.***

- *$HC\ell$ is 'n sterker suur as $CH_3COOH$ / $HC\ell$ het 'n hoër $K_a$-waarde as $CH_3COOH$*
- *$HC\ell$ sal 'n hoër konsentrasie van $H_3O^+$ produseer as $CH_3COOH$*

*OF*

- *$CH_3COOH$ is 'n swakker suur as $HC\ell$ / $CH_3COOH$ het 'n laer $K_a$-waarde as $HC\ell$*
- *$CH_3COOH$ sal 'n laer konsentrasie $H_3O^+$ produseer as $HC\ell$* (3)

7.2.1

$n = cV$ ✓
$= 1 \times 10 / 1\,000$ ✓
$= 0{,}01$ mol ✓ (3)

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7.2.2

| **Marking criteria** | **Marking criteria** |
|---|---|
| • Formula pH = - log $[H_3O^+]$ ✓<br>• pH value substituted into formula ✓<br>• Substitution in $K_w$ formula✓<br>• Substitution into n = cV✓<br>• Final answer✓<br><br>***Nasienkriteria***<br>• *Formule pH = - log $[H_3O^+]$*<br>• *pH-waarde vervang in formule*<br>• *Vervanging in $K_w$ formule*<br>• *Vervanging in n = cV*<br>• *Finale antwoord* | • Formula pOH + pH = 14 ✓<br>• pH value substituted into formula ✓<br>• Substitution in pOH formula✓<br>• Substitution into n = cV✓<br>• Final answer✓<br>***Nasienkriteria***<br>• *Formule pOH + pH = 14*<br>• *pH-waarde vervang in formule*<br>• *Vervanging in pOH formule*<br>• *Vervanging in n = cV*<br>• *Finale antwoord* |

| **OPTION 1 / *OPSIE 1*** | **OPTION 2 / *OPSIE 2*** |
|---|---|
| pH = - log $[H_3O^+]$ ✓ | pOH + pH = 14 ✓ |
| 13 ✓ = - log $[H_3O^+]$ | pOH + 13 ✓ = 14 |
| $[H_3O^+] = 1 \times 10^{-13}$ mol·dm$^{-3}$ | pOH = 1 |
| $K_w = [OH^-][H_3O^+] = 1 \times 10^{-14}$ | pOH = - log $[OH^-]$ |
| $[OH^-][H_3O^+] = 1 \times 10^{-14}$ | 1 = - log $[OH^-]$ ✓ |
| $[OH^-](1 \times 10^{-13}) = 1 \times 10^{-14}$ ✓ | $[OH^-] = 0,1$ mol·dm$^{-3}$ |
| $[OH^-] = 0,1$ mol·dm$^{-3}$ | [NaOH] = 0,1 mol·dm$^{-3}$ |
| [NaOH] = 0,1 mol·dm$^{-3}$ | |
| c = $\frac{n}{V}$ **OR/*OF*** | $c_1V_1 = c_2V_2$ |
| From 7.2.1 / *Vanaf 7.2.1* | $\underline{(1)(10) = (0,1)V_2}$ ✓ |
| 0,1 = $\frac{0,01}{V}$ ✓ | $V_2 = 100$ cm$^3$ |
| V = 0,1 (dm$^3$)✓ | V = 0,1 (dm$^3$) ✓ |

(5)

7.2.3

**Marking criteria**

- Formula n = cV✓
- Substitution of acid values into n = cV ✓

**AND**

**Using** ratio Acid : Base = 1 : 2

- Substitution of V and c into n = cV for V base reacting ✓
- Subtracting

$V_{remaining} = V_{initial} - V_{reacting}$ ✓

- Final answer ✓

***Nasienkriteria***

- *Formule n = cV*
- *Vervanging van suur waardes in formule n = cV*

***EN***

***Gebruik*** *verhouding Suur : Basis* = 1 : 2

- *Vervanging van V en c in n = cV vir V basis wat reageer*
- *Aftrekking*

$V_{oorbly} = V_{aanvangs} - V_{reageer}$

- *Finale antwoord*

**Marking criteria /**

- Formula $\frac{c_aV_a}{c_bV_b} = \frac{n_a}{n_b}$ ✓
- Substitution LHS $\frac{c_aV_a}{c_bV_b}$✓
- Substitution RHS $\frac{n_a}{n_b}$ ✓
- Subtracting

$V_{remaining} = V_{initial} - V_{reacting}$ ✓

- Final answer ✓

***Nasienkriteria***

- *Formule* $\frac{c_aV_a}{c_bV_b} = \frac{n_a}{n_b}$
- *Vervang LK* $\frac{c_aV_a}{c_bV_b}$
- *Vervang RK* $\frac{n_a}{n_b}$
- *Aftrekking*

$V_{oorbly} = V_{aanvangs} - V_{reageer}$

- *Finale antwoord*

**OPTION 1/*OPSIE 1***

n acid reacting = cV✓
= 0,09 x 15/1 000
= $1,35 \times 10^{-3}$ mol ✓

n base reacting = $2 \times 1,35 \times 10^{-3}$ mol
= $2,7 \times 10^{-3}$ mol

n = cV

$2,7 \times 10^{-3} = 0,1\ V_{base\ reacting}$ /*basis reageer*✓

$0,027\ dm^3 = V_{base\ reacting}$/ *basis reageer*

$V_{remaining/oorbly} = 0,1 - 0,027$ ✓
$= 0,073\ dm^3$ ✓

**OPTION 2/OPSIE 2**

$\frac{c_aV_a}{c_bV_b} = \frac{n_a}{n_b}$ ✓

$\frac{(0,09)(15)}{(0,1)V_b}$ ✓ $= \frac{1}{2}$ ✓

$V_b = 27\ cm^3$

$V_b = 0,027\ dm^3$

(5)
**[20]**

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## QUESTION/*VRAAG 8*

8.1 Loss of electrons / *Verlies aan elektrone* ✓✓ **(2 or/*of* 0)** (2)

8.2.1 1 mol·dm$^{-3}$ ✓ (1)

8.2.2 Platinum ✓ (1)

8.2.3 Cu ✓ (1)

8.2.4 $O_2 + 4H^+ + 4e^- \rightarrow 2\ H_2O$ ✓✓

**Marking criteria / *Nasienkriteria***
- $O_2 + 4H^+ + 4e^- \rightleftharpoons 2\ H_2O$ ½
- $2\ H_2O \leftarrow O_2 + 4H^+ + 4e^-$ 2/2
- $2\ H_2O \rightleftharpoons O_2 + 4H^+ + 4e^-$ 0/2
- $2\ H_2O \rightarrow O_2 + 4H^+ + 4e^-$ 0/2

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

(2)

8.2.5 $2\ Cu + O_2 + 4\ H^+$ ✓→ $2\ Cu^{2+} + 2\ H_2O$ ✓ (✓ bal)

**Marking criteria/*Nasienkriteria***
- Reactants/ *Reaktanse*
- Products / *Produkte*
- Balancing / *Balansering*

(3)

8.3.1 $E^\theta_{cell} = E^\theta_{cathode/reduction/oxidising\ agent} - E^\theta_{anode/oxidation/reducing\ agent}$ ✓

$E^\theta_{cell} = (1{,}23)$ ✓ – $(0{,}34)$ ✓

$E^\theta_{cell} = 0{,}89$ V ✓

**Notes/*Aantekeninge***
- Any other formula using unconventional abbreviation , e.g. $E^o_{cell} = E^o_{OA} - E^o_{RA}$ followed by the correct substitution : ¾
- *Enige ander formule wat onkonvensionele afkortings gebruik bv.*
- *$E^o_{sel} = E^o_{OM} - E^o_{RM}$ gevolg met korrekte vervangings: ¾*

(4)

8.3.2 Concentration of the reactants decreases ✓
Rate of the forward reaction decreases ✓

*Konsentrasie van reaktanse verlaag*
*Tempo van voortwaartse reaksie verlaag* (2)

8.3.3 Equilibrium / *Ewewig* ✓ (1)

**[17]**

**QUESTION/*VRAAG 9***

9.1.1

**Marking criteria/ Nasienriglyne**
If any of the underlined key words/phrases in the **correct context** are omitted: - 1 mark per word/phrase.
*Indien enige van die sleutelwoorde/frases in die korrekte konteks weggelaat word: - 1 punt per woord/frase*

(It is a cell in which) electrical energy ✓ is converted into chemical energy ✓

*(Dit is 'n sel waarin) elektriese energie omgeskakel word na chemiese energie.* (2)

9.1.2 $2\ C\ell^- \rightarrow C\ell_2(g) + 2e^-$ ✓✓

Ignore phases / *Ignoreer fases* (2)

**Marking criteria / *Nasienkriteria***
- $2\ C\ell^- \rightleftharpoons C\ell_2(g) + 2e^-$ ½
- $C\ell_2(g) + 2e^- \leftarrow 2\ C\ell^-$ 2/2
- $C\ell_2(g) + 2e^- \rightleftharpoons 2\ C\ell^-$ 0/2

Ignore if the charge omitted on electron / *Ignoreer indien lading weggelaat is op elektron*

9.1.3 $H_2$ / Hydrogen gas / *Waterstofgas* (1)

9.1.4 $H_2O$ is a stronger oxidising agent than $Na^+$ ✓
$H_2O$ is reduced to $H_2$ ✓

*$H_2O$ is 'n sterker oksideermiddel as $Na^+$*
*$H_2O$ word gereduseer na $H_2$* (2)

9.2.1 Cathode / *Katode* ✓ (1)

9.2.2 $n_{Cu} = ½ \times 6$ ✓
$= 3$ mol

$m_{Cu} = nM = 3 \times 63,5$✓

$= 190,5$ g

0,95 ✓$m_{IMPURE\ sample} = 190,5$

$m_{IMPURE\ sample} = 200,53$ g ✓

**Marking criteria**
- Use of ratio of electrons to Cu
- Subst. into n = m/M
- Division by 0,95
- Final answer

***Nasienkriteria***
- *Gebruik van verhouding van elektrone tot Cu*
- *Vervanging in n = m/M*
- *Deel deur 0,95*
- *Finale antwoord*

(4)
**[12]**

**TOTAL/*TOTAAL*: 150**

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