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**NATIONAL
SENIOR CERTIFICATE/
NACIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

JUNE/JUNIE 2025

**PHYSICAL SCIENCES: CHEMISTRY P2/
FISIESE WETENSKAPPE: CHEMIE V2
MARKING GUIDELINE/NASIENRIGLYN**

MARKS/PUNTE: 150

This marking guideline consists of 15 pages./
Hierdie nasienriglyn bestaan uit 15 bladsye.



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QUESTION/VRAAG 1

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



QUESTION/VRAAG 2

- 2.1 A bond or an atom or a group of atoms that determine(s) the physical and chemical properties of a group of organic compounds. ✓✓

in Binding of 'n atoom of 'n groep atome wat die fisiese en chemiese eienskappe van 'n groep organiese verbindings bepaal. (2)

- 2.2 2.2.1 A ✓ (1)

- 2.2.2 C ✓ (1)

- 2.2.3 B ✓ (1)

- 2.3 2.3.1 3-methylbutanal ✓✓
3-metielbutanaal

Marking criteria/Nasienkriteria:

- Butanal / butanaal ✓
- Whole name correct / Hele naam korrek ✓

(2)

- 2.3.2 4-methylpent-2-yne ✓✓
4-metieipent-2-yn

Marking criteria/Nasienkriteria:

- Pent-2-yne / pent-2-yn ✓
- Whole name correct / Hele naam korrek ✓✓

OR/OF

- 4-methyl-2-pentyne ✓✓
4-metiel-2-pentyn

(2)

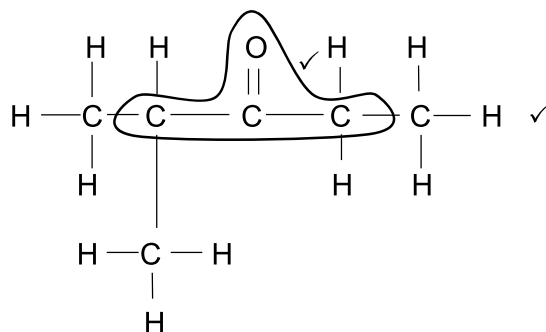
- 2.3.3 2,3-dibromo-4-ethylhexane ✓✓✓
2,3-dibromo-4-etielheksaan

Marking criteria/Nasienkriteria:

- Hexane / heksaan ✓
- dibromo and ethyl / dibromo en etiel ✓
- Whole name correct / Hele naam korrek ✓

(3)

- 2.4 2.4.1

**Markingcriteria****/Nasienkriteria**

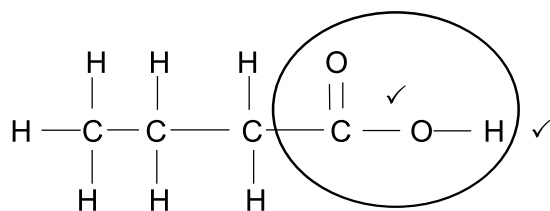
- Correct functional group / Funksionele groep korrek ✓
1/2
- Whole structure correct/ Hele struktuur korrek ✓ 2/2

(2)

- 2.4.2 Esterification / Condensation / Esterifikasie / Kondensasie ✓ (1)



2.4.3

**Marking criteria/Nasienkriteria**

- Correct functional group / *Funksionele groep korrek* ✓ 1/2
- Whole structure correct/ *Hele struktuur korrek* ✓ 2/2

(2)

2.5 2.5.1 $43,24 = \frac{M}{74} \times 100$ ✓

$$M = 31,9976$$

$$M = 32 \text{ g} \cdot \text{mol}^{-1}$$

$$M(\text{O}) = 16 \text{ g} \cdot \text{mol}^{-1}$$

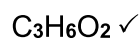


Organic compound is either carboxylic acid or ester.

*Organiese verbinding is 'n karboksiesuur of 'n ester.*General formula / *Algemene formule*: $\text{C}_n\text{H}_{2n}\text{O}_2$

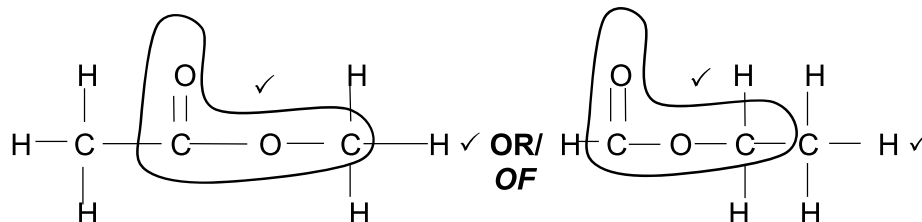
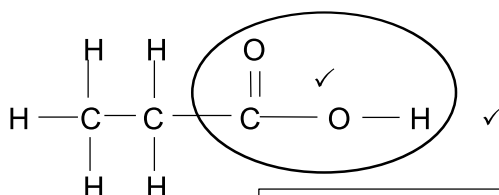
$$12 \times n + 2 \times n + 32 = 74$$
 ✓

$$n = 3$$



(3)

2.5.2

**AND/EN****Marking criteria/Nasienkriteria**

- Correct functional group / *Funksionele groep korrek* ✓ 1/2
- Whole structure correct/ *Hele struktuur korrek* ✓ 2/2

(4)

[24]

QUESTION/VRAAG 3

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.

- 3.1 Boiling point is the temperature at which the vapour pressure of a substance /liquid equal the atmospheric pressure ✓✓

Kookpunt is die temperatuur waarteen die dampdruk van 'n stof/vloeistof gelyk aan die atmosferiese druk is

(2)

- 3.2 Same functional group / Same homologous series ✓

Dieselfde funksionele groep / Dieselfde homoloëreeks

Accept same type of intermolecular forces/Aanvaar dieselfde tipe van intermolekulêre kragte

(1)

- 3.3 **Marking criteria**

- The boiling point increases down the table
- Chain length / molecular size increases down the table
- Increase in the strength of the London forces/Dispersion forces/Induced dipole forces / down the table
- Relate the strength of London forces /dispersion forces/induced dipole to energy involved

Nasienkriteria

- *Die kookpunt styg teen die tafel af*
- *Kettinglengte / molekulêre grootte neem teen die tabel af*
- *Toename in die sterkte van die Londonkragte /Dispersiekragte /Geïnduseerde dipoolkragte / teen die tabel af*
- *Verband hou met die sterkte van die Londonkragte/ verspreidingskrag/ geïnduseerde dipoolkragte met die energie betrokke*

- The trend shows an increase in the boiling point down the table ✓
- Increase in the surface area/chain length/molecular size down the table ✓
- Strength of London forces/dispersion forces/induced dipole forces / increases ✓
- More energy is needed to overcome intermolecular forces ✓

- *Die tendens toon 'n toename in die kookpunt teen die tabel af*
- *Toename in die oppervlakte/ketting lengte/molekulêre grootte teen die tabel af*
- *Sterkte van die Londonkragte/verspreidingskragte/geïnduseerde dipoolkragte neem toe*
- *Meer energie word benodig om die intermolekulêre kragte te oorkom*

(4)

- 3.4 Decreases. ✓ The boiling point increases. ✓

Afneem. Die kookpunt neem toe.

(2)



- 3.5 2-methylpropan-1-ol / 2-methyl-1-propanol ✓✓
2-metielpropan-1-ol/ 2-metiel-1-propanol

Marking criteria/Nasienkriteria:

- Propan-1-ol ✓
- Whole name correct / Hele naam korrek ✓

(2)

3.6

Marking criteria

- Compare the boiling point of the alcohol to the alcohol with 3-carbon atom alcohol
- Compare the surface area/chain length/molecular size of the alcohol to the alcohol with 3-carbon atoms
- Compare the boiling point of the alcohol to the alcohol with 4-carbon atoms
- Compare the surface area/chain length of the alcohol to the alcohol with 4-carbon atoms

Nasienkriteria

- Vergelyk die kookpunt van die alkohol met die 3-koolstof atoom alkohol
- Vergelyk die oppervlakte/kettinglengte/molekulêre grootte van die alkohol met die 3-koolstof atoom alkohol
- Vergelyk die kookpunt van die alkohol met die 4-koolstof atoom alkohol
- Vergelyk die oppervlakte/kettinglengte van die alkohol met die 4-koolstof atoom alkohol

- The boiling point of the unknown alcohol (2-methylpropan-1-ol) is higher than that of the alcohol with 3-carbon atoms (propan-1-ol) ✓
- Surface area / chain length / molecular size is greater than the alcohol with 3-carbon atoms (propan-1-ol) ✓
- The boiling point of the unknown alcohol (2-methylpropan-1-ol) is smaller than that of the straight chain alcohol with 4-carbon atoms (butan-1-ol) ✓
- Surface area / chain length is smaller than the straight chain alcohol with 4-carbon atoms (butan-1-ol) ✓

- Die kookpunt van die onbekende alkohol (2-metielpropan-1-ol) is hoër as dié alkohol met 3-koolstofatome (propan-1-ol)
- Oppervlakte / kettinglengte / molekulêre grootte is groter as die alkohol met 3-koolstof atome (propan-1-ol)
- Die kookpunt van die onbekende alkohol (2-metielpropan-1-ol) is laer as die reguitketting alkohol met 4-koolstofatome (butan-1-ol)
- Oppervlakte / kettinglengte is kleiner as die reguitketting alkohol met 4-koolstof atome (butan-1-ol)

(4)

[15]

QUESTION/VRAAG 4

- 4.1 4.1.1 Breaking down of long chain hydrocarbon molecules into more useful shorter chains ✓✓ (2 or 0)
Die afbreek van lang kettingkoolwaterstof-molekules in meer bruikbare, molekule korter kettings (2 of 0) (2)

- 4.1.2 C_2H_4 ✓✓ (2)

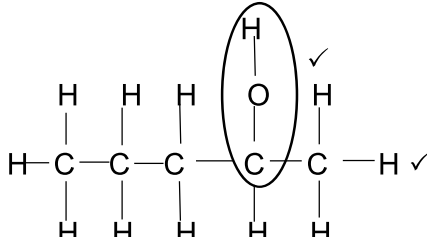
- 4.1.3 Used as a fuel / Word as 'n brandstof gebruik ✓ (1)

- 4.1.4 $C_5H_{12} + 8 O_2 \checkmark \longrightarrow 5 CO_2 + 6 H_2O \checkmark$ (✓ bal.)
 Reactants, ✓ products ✓ and balancing ✓
Reaktanse, produkte en balansering (3)

- 4.2 4.2.1 2-bromopentane / 2-bromopentaaan ✓✓ (2)

- 4.2.2 Substitution/ Hydrolysis of haloalkanes / *Substitusie / Hydrolise van haloalkane* ✓ (1)

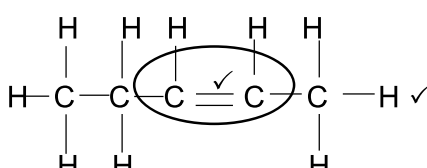
- 4.2.3 Diluted strong base / diluted NaOH ✓
Verdunde sterk basis / verdunde NaOH (1)

- 4.2.4
- 

Marking criteria/Nasienkriteria

 - Correct functional group / *Funksionele groep korrek* ✓ 1/2
 - Whole structure correct/ *Hele struktuur korrek* ✓ 2/2
- (2)

- 4.2.5 Dehydration / *Dehidrasie / Dihidratering* ✓ (1)

- 4.2.6
- 

Marking criteria/Nasienkriteria

 - Correct functional group / *Funksionele groep korrek* ✓ 1/2
 - Whole structure correct/ *Hele struktuur korrek* ✓ 2/2
- (2)

[17]

QUESTION/VRAAG 5

5.1 EXOTHERMIC / EKSOTERMIES. ✓ $\Delta H < 0$ ✓ (2)

5.2 Carbon dioxide (CO₂) gas escapes / Koolstof dioksied (CO₂) gas ontsnap ✓✓ (2)

5.3 189 g ✓ Accept/Anvaar (188,5 – 189) (1)

5.4 5.4.1 11 (minutes / minute) accept/ aanvaar 10 (minutes / minute) ✓ (1)

5.4.2 EQUAL TO ✓

The amount of CaCO₃ consumed is equal to the amount of CO₂ produced / the mol ratio of CaCO₃ to CO₂ is 1 : 1. ✓

The time taken for consumption and production is the same. ✓

GELYK AAN

Die hoeveelheid CaCO₃ verbruik is gelyk aan die hoeveelheid CO₂ vervaardig / die molverhouding van CaCO₃ tot CO₂ is 1 : 1.

Die tyd geneem vir die verbruik en vervaardiging is dieselfde. (3)

5.4.3

Marking criteria / Nasienkriteria

- (a) Subtract / Aftrek 200 – 185
- (b) Subst. into / Vervanging in $n = m/M$
- (c) Formula / Formule $V = nV_m$
- (d) Subst. into/ Vervanging in $V = nV_m$
- (e) Final answer/ Finale antwoord

$$n = \frac{M}{m}$$

$$n = \frac{200 - 185 \checkmark (a)}{44} \checkmark (b)$$

$$n = 0,34 \text{ mol}$$

$$V = nV_m \checkmark (c)$$

$$V = (0,34)(24000) \checkmark (d)$$

$$V = 8\,160 \text{ (cm}^3\text{)} \checkmark (e)$$

$$\text{Range} = 8160 - 8181,82 \quad (5)$$



5.4.4 **Marking criteria/Nasienkriteria**

- (a) Use of mol ratio / *Gebruik van molverhouding* $\text{CO}_2 : \text{CaCO}_3$
- (b) Subst. into/ *Vervanging in* $n = m/M$
- (c) Subst. into rate equation/ *Vervanging in tempo vergelyking*
- (d) Final answer / *Finale antwoord*

Positive marking from/Positiewe nasien van 5.4.3

$$n(\text{CO}_2) = n(\text{CaCO}_3) = 0,34 \text{ mol} \checkmark \text{ (a)}$$

$$m = nM$$

$$m = (0,34)(100) \checkmark \text{ (b)}$$

$$m = 34 \text{ g}$$

$$\frac{\text{rate/}}{\text{tempo}} = - \frac{\Delta m}{\Delta t}$$

$$\frac{\text{rate/}}{\text{tempo}} = - \frac{0 - 34}{11} \checkmark \text{ (c)}$$

$$m = 3,09 \text{ g} \cdot \text{min}^{-1} \checkmark \text{ (d)} \quad (4)$$

5.5 5.5.1 **Marking criteria for hypothesis**

- Statement regarding the correct independent and dependent variable

- Statement is measurable

Nasienkriteria vir hipotese

- *Stelling om die onafhanklike en afhanklike veranderlike is korrek*
- *Stelling is meetbaar*

A(n) decrease / increase in temperature will decrease / increase the reaction rate.

'n Afname/ toename in temperatuur sal die reaksietempo laat afneem/ toeneem. (2)

5.5.2 INCREASES / TOENEEM $\checkmark$ (1)

- 5.5.3
- Higher temperature means the average kinetic energy of the particles increases $\checkmark$
 - More particles will have sufficient kinetic energy / more particles will have kinetic energy equal to or higher than the activation energy $\checkmark$
 - More effective collisions per unit time / Frequency of the effective collisions increases $\checkmark$



- Hoër temperatuur beteken die gemiddelde kinetiese energie van die deeltjies neem toe
- Meer deeltjies het genoeg kinetiese energie / meer deeltjies het kinetiese energie gelyk of hoër as die aktiveringsenergie
- Meer effektiewe botsings per tydseenheid / Frekwensie van die effektiewe botsings neem toe

(3)
[24]

QUESTION/VRAAG 6

6.1.1 **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.

When the equilibrium in a closed system is disturbed, the system will re-instate a new equilibrium by favouring the reaction that will oppose/cancel the disturbance. ✓✓

Wanneer die ewewig in 'n geslote sisteem versteur word, sal die sisteem 'n nuwe ewewig deur die reaksie wat die versteuring teenwerk/kanseleer, te bevoordeel. (2)

6.1.2 (a) NO EFFECT / GEEN EFEEK ✓ (1)

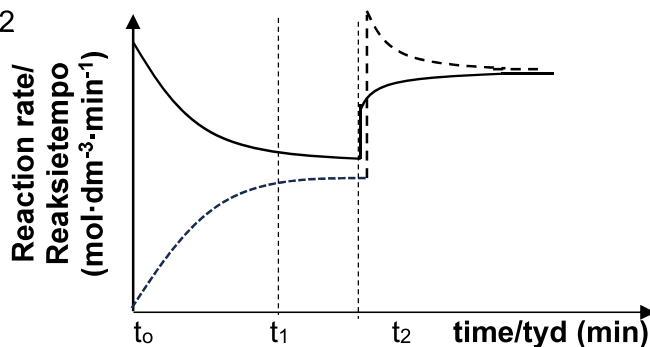
(b) INCREASES / TOENEEM ✓ (1)

(c) DECREASES / AFNEEM ✓

- An increase in pressure favours the reaction that produces the least number of gaseous moles. ✓
- Mole ratio of reactants : products 1 : 2 ✓
- The reverse reaction is favoured / the equilibrium position shifted towards left. ✓
- 'n Toename in druk bevoordeel die reaksie wat die minste gasmol produseer.
- Die molverhouding reaktanse : produkte 1 : 2
- Die terugwaartse reaksie word bevoordeel / die ewewigsposisie verskuif links. (4)

6.2 6.2.1 $2\text{NO}_2(\text{g}) \rightarrow \text{N}_2\text{O}_4(\text{g})$ ✓✓ (2)

6.2.2

**Marking criteria/****Nasienkriteria**

Both graphs rates increases vertically and reached new equilibrium ✓

Increase in the reverse reaction rate is higher than the forward rate ✓

Beide grafieke se tempo neem vertikaal toe en bereik 'n nuwe ewewig

Toename in die tempo van die terugwaartse reaksie is hoër as die tempo van die voortwaartse reaksie

(2)

$$6.3 \quad 6.3.1 \quad K_c = \frac{[\text{NO}_2]^2}{[\text{N}_2\text{O}_4]} \quad \checkmark$$

$$K_c = \frac{(0,0457)^2}{(0,448)} \quad \checkmark$$

$$K_c = 4,66 \times 10^{-3} \quad \checkmark$$

(3)

6.3.2 LOW YIELD. ✓ K_c is less than 1. ✓
LAE OPBRENGS. K_c is kleiner as 1.

(2)

6.3.3 **POSITIVE MARKING FROM / POSITIEWE NASIEN VANAF 6.3.1**
MARKING CRITERIA

- Subst. K_c value and correct N_2O_4 concentration into the correct K_c expression ✓
- Determine the change in concentration of NO_2 ✓
- Correct ratio N_2O_4 and NO_2 ✓
- Determine the initial concentration N_2O_4 ✓
- Subst. change in concentration and initial concentration of N_2O_4 in % change formula ✓
- Final answer ✓

NASIENKRITERIA

- Vervang die K_c -waarde en korrekte N_2O_4 konsentrasie in die korrekte K_c -uitdrukking
- Bepaal die verandering in die konsentrasie van NO_2
- Korrekte verhouding tussen N_2O_4 en NO_2
- Bepaal die aanvanklike konsentrasie van N_2O_4
- Vervanging in verandering in konsentrasie en die aanvanklike konsentrasie van N_2O_4 in die % verandering formule
- Finale antwoord



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$$K_c = \frac{[\text{NO}_2]^2}{[\text{N}_2\text{O}_4]}$$

$$4,66 \times 10^{-3} = \frac{[\text{NO}_2]^2}{(0,491)} \quad (\text{a}) \checkmark$$

$$[\text{NO}_2] = 0,0478 \text{ mol} \cdot \text{dm}^{-3}$$

	N_2O_4	$2 \text{NO}_2 (\text{g})$
Initial conc/ <i>Aanvangskonsentrasie</i>	0,5 (d) $\checkmark$	0,03
Change in conc./ <i>Verandering in konsentrasie</i>	$8,9 \times 10^{-3}$	0,0178 (b) $\checkmark$
Equilibrium conc./ <i>Ewewigskonsentrasie</i>	0,491	0,0478

(c) ratio/
verhouding $\checkmark$

$$\% [\text{N}_2\text{O}_4] = \frac{8,9 \times 10^{-3}}{0,5} \times 100 \% \quad (\text{e}) \checkmark$$

$$\% [\text{N}_2\text{O}_4] = 1,78 \% \quad (\text{f}) \checkmark$$

(6)
[23]



QUESTION/VRAAG 7

- 7.1 7.1.1 An acid is a proton (H^+) donor ✓✓ (2 or 0)
 'n Suur is proton (H^+) skenker (2 of 0) (2)
- 7.1.2 $CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$ ✓
 Ignore phases / Ignoreer fases (2)
- 7.1.3 Weak acid / Swaksuur ✓
 K_a value is less than 1 / K_a -waarde is kleiner as 1 ✓ (2)
- 7.1.4 Methanoic acid ✓
 It has the larger K_a -value / Ionises to a greater extent / It is the stronger acid. ✓
 The higher the concentration of the H_3O^+ the lower the pH-value. ✓
 Metanoësuur
 Dit is het die groter K_a -waarde / Ioniseer tot 'n groter mate / Dit is die sterker suur.
 Hoe hoër die konsentrasie van H_3O^+ hoe kleiner is is die pH-waarde (3)
- 7.2 7.2.1 Burette / Buret ✓ (1)
- 7.2.2 To ensure reliable results / accurate results ✓
 Om betroubare resultate / akkurate resultate te verseker (1)
- 7.2.3 8,3–10 ✓ (1)
- 7.2.4 $C_2O_4^{2-} + H_2O \rightarrow HC_2O_4^- + OH^-$ ✓
 (reactants / reaktanse and / en products / produkte)
 Excess OH^- is produced / Oormaat OH^- is geproduseer ✓ (3)
- 7.3 7.3.1 $n = cV$ ✓
 $n = (0,1)(25 \times 10^{-3})$ ✓
 $n = 2,5 \times 10^{-3} \text{ mol}$ ✓ (3)



7.3.2

OPTION 1 Marking criteria (a) pH formula (b) Subst. into pH-formula (c) Subst. into $K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$ (d) Final answer	OPTION 2 Marking criteria (a) Formula $\text{pH} + \text{pOH} = 14$ (b) Subst. into $\text{pH} + \text{pOH} = 14$ (c) Subst. into pOH formula (d) Final answer
OPSIE 1 Nasienkriteria (a) pH-formule (b) Vervang in pH-formule (c) Vervang in $K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$ (d) Finale antwoord	OPSIE 2 Nasienkriteria (a) Formule $\text{pH} + \text{pOH} = 14$ (b) Vervang in $\text{pH} + \text{pOH} = 14$ (c) Vervang in pOH-formule (d) Finale antwoord
$\text{pH} = -\log[\text{H}_3\text{O}^+] \checkmark$ (a) $12,52 = -\log[\text{H}_3\text{O}^+] \checkmark$ (b) $[\text{H}_3\text{O}^+] = 3,02 \times 10^{-13} \text{ mol}\cdot\text{dm}^{-3}$ $K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$ $1 \times 10^{-14} = (3,02 \times 10^{-13})[\text{OH}^-] \checkmark$ (c) $[\text{OH}^-] = 0,033 \text{ mol}\cdot\text{dm}^{-3} \checkmark$ (d)	$\text{pH} + \text{pOH} = 14 \checkmark$ (a) $12,52 + \text{pOH} = 14 \checkmark$ (b) $\text{pOH} = 1,48$ $\text{pOH} = -\log[\text{OH}^-]$ $1,48 = -\log[\text{OH}^-] \checkmark$ (c) $[\text{OH}^-] = 0,033 \text{ mol}\cdot\text{dm}^{-3} \checkmark$ (d)

(4)

7.3.3

POSITIVE MARKING FROM QUESTION 7.3.1 AND 7.3.2**POSITIEWE NASIEN VAN VRAAG 7.3.1 EN 7.3.2****Marking criteria**

- (a) Subst. 0,033 and V into $n = cV$
 (b) Subst. 0,033V, 0,1V and n equivalence point in
 $n_{\text{excess}} = n_{\text{totaal}} - n_{\text{ep}}$
 (c) Subst. into V (total volume) = V (volume titrated) + V (acid)
 (d) Subst. eq (2) into (1)
 (e) Final answer

Nasienkritria

- (a) Vervang 0,033 en V in $n = cV$
 (b) Vervang 0,033V, 0,1V en n ekwivalente punt in
 $n_{\text{oormaat}} = n_{\text{totaal}} - n_{\text{ekw}}$
 (c) Vervang in V (totale volume) = V (volume getitreer) + V (suur)
 (d) Vervang vergelyking (2) in (1)
 (e) Finale antwoord

$$n(\text{excess}) = n(\text{total}) - n(\text{equivalence point})$$

$$n(\text{oormaat}) = n(\text{totaal}) - n(\text{ekwivalente punt})$$

$$cV(\text{total volume}) = cV(\text{volume titrated}) - n(\text{equivalence point})$$

$$cV(\text{totaal volume}) = cV(\text{volume getitreer}) - n(\text{ekwivalente punt})$$

$$0,033V(\text{total volume}) \checkmark \text{ (a)} = 0,1V(\text{volume titrated}) - 2,5 \times 10^{-3} \dots (1) \checkmark$$

(b)

$$V(\text{total volume}) = V(\text{volume titrated}) + V(\text{acid})$$

$$V(\text{totale volume}) = V(\text{getitreer}) + V(\text{suur})$$



$$V \text{ (total volume)} = V \text{ (volume titrated)} + 25 \times 10^{-3} \dots (2) \text{ (c)} \checkmark$$

Subst. equation (2) into (1) / Vervang vergelyking (2) in (1)

$$0,033 [\text{Volume titrated} + 25 \times 10^{-3}] \checkmark \text{ (d)} = 0,1 \text{ Volume titrated} - 2,5 \times 10^{-3}$$

$$\text{Volume titrated} / \text{volume getitreer} = 0,050 \text{ dm}^3$$

$$\text{Volume titrated} / \text{volume getitreer} = 50 \text{ cm}^3 \checkmark \text{ (e)} \quad (5)$$

[27]

TOTAL/TOTAAL: 150

