



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 12

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

EXEMPLAR/MODEL 2014

MEMORANDUM

MARKS/PUNTE: 150

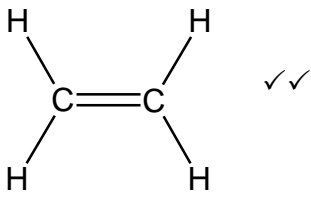
**This memorandum consists of 10 pages.
*Hierdie memorandum bestaan uit 10 bladsye.***

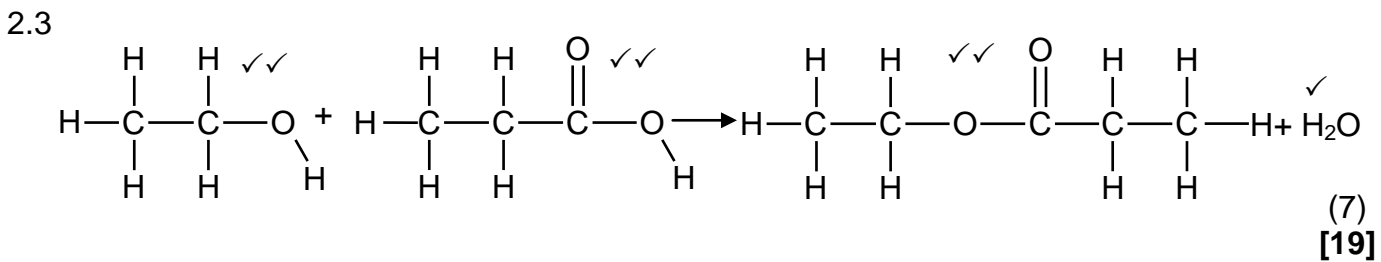
QUESTION 1/VRAAG 1

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

[20]

QUESTION 2/VRAAG 2

- 2.1
- 2.1.1 Alkynes / Alkyne ✓ (1)
- 2.1.2 Hydroxyl group / Hidroksielgroep ✓ (1)
- 2.1.3 C ✓ (1)
- 2.1.4 2-methylpentan-3-one / 2-metielpentan-3-oon ✓✓ (2)
- 2.1.5  ✓✓ (2)
- 2.1.6 $2C_4H_{10} + 13O_2 \checkmark \rightarrow 8CO_2 + 10H_2O \checkmark$ Bal. ✓ (3)
- 2.2 Same molecular formula, ✓
but different positions of the functional group. ✓
Dieselfde molekulêre formule,
maar verskillende posisies van die funksionele groep. (2)



QUESTION 3/VRAAG 3

3.1 Temperature ✓ at which the vapour pressure of the substance equals atmospheric pressure. ✓
Temperatuur waar die dampdruk van die stof gelyk is aan atmosferiese druk. (2)

3.2

3.2.1 Boiling point increases as the chain length / molecular mass increases. ✓
Kookpunt neem toe soos wat die kettinglengte / molekulêre massa toeneem.

OR/OF

Boiling point increases from methane to butane.

Kookpunt neem toe van metaan na butaan. (1)

3.2.2

- Chain length increases from methane to butane. ✓
Kettinglengte neem toe van metaan na butaan.
- Strength of London forces / induced dipole forces increases from methane to butane. ✓
Sterkte van Londonkragte / geïnduseerde dipoolkragte neem toe van metaan na butaan.
- More energy needed to overcome intermolecular forces in butane than in methane. ✓
Meer energie benodig om intermolekulêre kragte in butaan as in metaan te oorkom. (3)

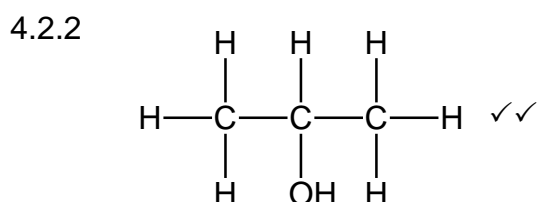
3.3 Between molecules of the alkanes are weak London forces or induced dipole forces. / *Tussen molekule van alkane is swak Londonkragte of geïnduseerde dipoolkragte.* ✓
Between alcohol molecules are, in addition to weak London forces or induced dipole forces, also strong hydrogen bonds. / *Tussen alkoholmolekule is sterk waterstofbindings bykomend by tot swak Londonkragte of geïnduseerde dipoolkragte.* ✓ (2)

[8]

QUESTION 4/VRAAG 4

4.1 Alkenes / Alkene ✓ (1)

4.2
4.2.1 Addition / Hydrohalogenation / Hydrochlorination ✓
Addisie / Hidrohalogeneging / Hidrochloronering (1)



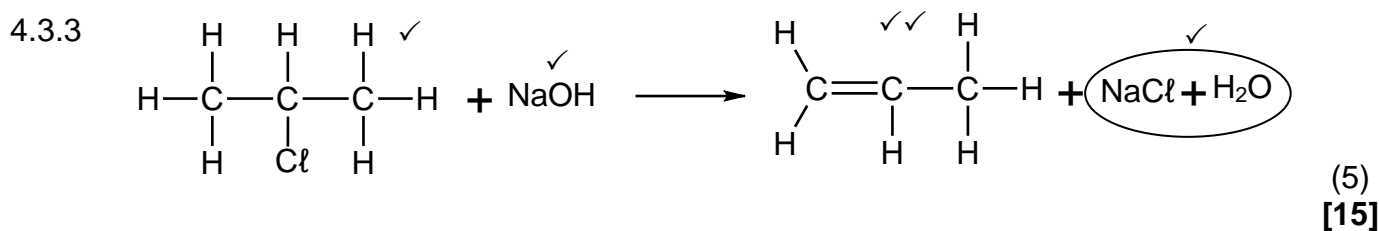
Propan-2-ol ✓ (3)

4.2.3 Elimination / Dehydration ✓
Eliminasie / Dehidrasie (1)

4.2.4 Catalyst / Katalisator ✓ (1)

4.3
4.3.1 Sodium hydroxide / Potassium hydroxide ✓
Natriumhidroksied / Kaliumhidroksied (1)

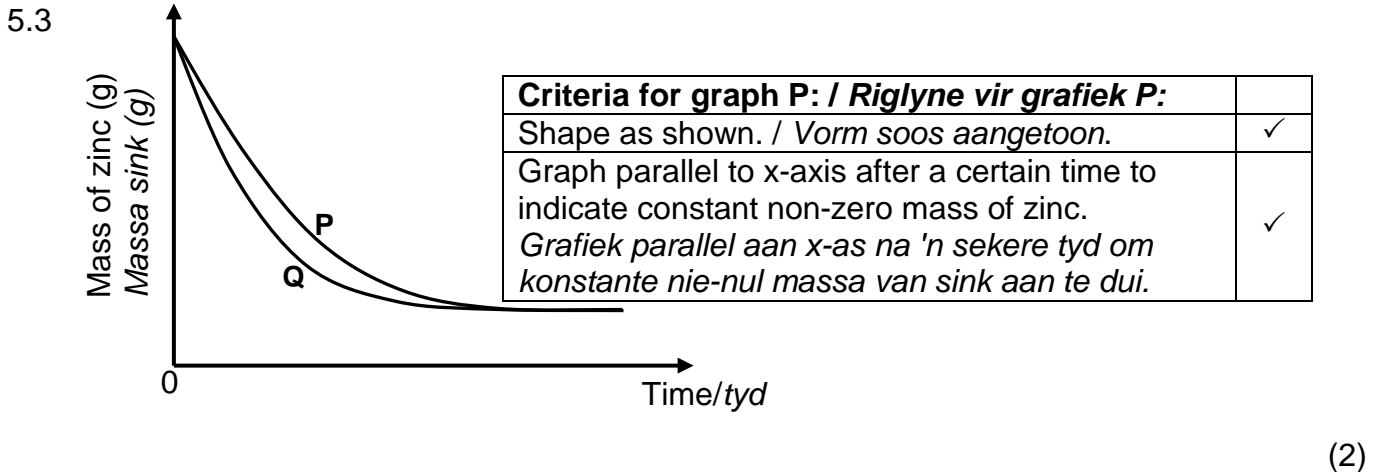
4.3.2 Dissolve base in ethanol. / Concentrated (strong) base) ✓
Heat strongly. ✓
Los basis op in etanol. / Gekonsentreerde (sterk) basis
Verhit sterk. (2)



QUESTION 5/VRAAG 5

5.1 Hydrochloric acid / HCl / Soutsuur ✓ (1)

5.2 Hydrogen gas escapes from the flask. ✓
Waterstofgas ontsnap uit die fles. (1)



5.4

Criteria for graph Q / Riglyne vir grafiek Q:	
Steeper gradient than Graph P. / Steiler gradiënt as Grafiek P.	✓
Joins parallel section of Graph P after a shorter time. Verbind met die parallelle deel van Grafiek P na 'n korter tyd.	

(1)

5.5 At a higher temperature:

- More molecules have sufficient kinetic energy / kinetic energy equal to or greater than the activation energy. ✓
- More effective collisions per unit time / second. ✓

By 'n hoër temperatuur:

- Meer molekule het voldoende kinetiese energie / kinetiese energie gelyk aan of groter as die aktiveringsenergie.
- Meer effektiewe botsings per eenheidstyd / sekond. ✓

(2)

5.6 $c(\text{HCl}) = \frac{n}{V}$ ✓

$\therefore 0,2 = \frac{n}{0,1}$ ✓

$\therefore n(\text{HCl}) = 0,02 \text{ mol}$

$n(\text{Zn}) = \frac{1}{2}n(\text{HCl}) = 0,01 \text{ mol}$ ✓

$m(\text{Zn reacted / gereageer}) = nM$ ✓
 $= (0,01)(65)$ ✓
 $= 0,65 \text{ g}$

Mass of Zn initially in flask / Massa Zn aanvanklik in fles:
 $0,65 + 0,12 = 0,77 \text{ g}$ ✓

(6)

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QUESTION 6/VRAAG 6

- 6.1 The stage in a chemical reaction when the rate of forward reaction equals the rate of reverse reaction. ✓✓
Die stadium in 'n chemiese reaksie wanneer die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie. ✓✓ (2)
- 6.2
 6.2.1 Higher than / *Hoër as* ✓ (1)
 6.2.2 Equal to / *Gelyk aan* ✓ (1)
- 6.3
 6.3.1 NO₂(g) added / *bygevoeg* ✓ (1)
 6.3.2 Decrease in pressure / *Afname in druk* ✓ (1)
- 6.4 Increases ✓
 An increase in temperature favours the endothermic reaction. ✓
 The forward reaction is endothermic. / The forward reaction is favoured. ✓
Verhoog
'n Toename in temperatuur bevoordeel die endotermiese reaksie.
Die voorwaartse reaksie is endotermies. / Die voorwaartse reaksie word bevoordeel. (3)
- 6.5

	N ₂ O ₄	NO ₂	
Initial quantity (mol) <i>Aanvangshoeveelheid (mol)</i>	0,92	0	
Change (mol) <i>Verandering (mol)</i>	0,19 ✓	0,38	ratio ✓ <i>verhouding</i>
Quantity at equilibrium (mol)/ <i>Hoeveelheid by ewewig (mol)</i>	0,73	0,38 ✓	
Equilibrium concentration (mol·dm ⁻³) <i>Ewewigkonsentrasie (mol·dm⁻³)</i>	$\frac{0,73}{2} = 0,37$	$\frac{0,38}{2} = 0,19$	

$$\begin{aligned}
 K_C &= \frac{[\text{NO}_2]^2}{[\text{N}_2\text{O}_4]} \checkmark \\
 &= \frac{(0,19)^2}{(0,37)} \checkmark \\
 &= 9,76 \times 10^{-2} \checkmark
 \end{aligned}$$

Divide by / *gedeel deur 2* ✓

No K_C expression, correct substitution /
Geen K_C-uitdrukking, korrekte substitusie:
 Max. / *Maks.* $\frac{6}{7}$

Wrong K_C expression / *Verkeerde K_C-
 uitdrukking:* Max. / *Maks.* $\frac{4}{7}$

(7)

[16]

QUESTION 7/VRAAG 7

7.1 An acid forms hydronium ions / H_3O^+ ions when it dissolves in water. ✓
'n Suur vorm hidroniumione / H_3O^+ -ione wanneer dit in water oplos. (2)

7.2 Incompletely / partially ionised ✓
Onvolledig / gedeeltelik geïoniseer (1)

7.3 Solution of known concentration. / *Oplossing van bekende konsentrasie.* ✓ (1)

7.4 Burette / *Buret* ✓
 Pipette / *Pipet* ✓ (2)

7.5

OPTION 1/OPSIE 1	OPTION 2/OPSIE 2
$K_w = [\text{H}_3\text{O}^+][\text{OH}^-]$ $\therefore 1 \times 10^{-14} = [\text{H}_3\text{O}^+](0,5) \checkmark$ $\therefore [\text{H}_3\text{O}^+] = 2 \times 10^{-14} \text{ mol}\cdot\text{dm}^{-3}$ $\text{pH} = -\log[\text{H}_3\text{O}^+] \checkmark$ $= -\log(2 \times 10^{-14}) \checkmark$ $= 13,7 \checkmark$	$\text{pOH} = -\log[\text{OH}^-] \checkmark$ $= -\log(0,5) \checkmark$ $= 0,3$ $\text{pH} = 14 - \text{pOH} \checkmark$ $= 14 - 0,3$ $= 13,7 \checkmark$

(4)

7.5.2 $n(\text{NaOH}) = cV \checkmark$
 $= (0,5)(0,04) \checkmark$
 $= 0,02 \text{ mol}$

\swarrow

$n(\text{CH}_3\text{COOH}) = n(\text{NaOH}) = 0,02 \text{ mol} \checkmark$

\swarrow

$m(\text{CH}_3\text{COOH}) = nM \checkmark$
 $= (0,02)(60) \checkmark$
 $= 1,2 \text{ g}$

\swarrow

$\% \text{ mass of / massa van } \text{CH}_3\text{COOH} = \frac{1,2}{20} \times 100 \checkmark = 6\% \checkmark$ (7)

7.6 $\text{CH}_3\text{COO}^-(\text{aq}) + \text{H}_2\text{O}(\ell) \checkmark \rightarrow \text{CH}_3\text{COOH}(\text{aq}) + \text{OH}^-(\text{aq}) \checkmark$ Bal. ✓ (3)
[20]

QUESTION 8/VRAAG 8

- 8.1 1 mol·dm⁻³ ✓ (1)
- 8.2 Iodine is not a conductor. / *Jodium is nie 'n geleier nie.* ✓ (1)
- 8.3 Graphite is a conductor. / *Grafiet is 'n geleier.* ✓
Graphite is inert. / *Grafiet is onaktief/traag.* ✓ (2)
- 8.4
- 8.4.1 Permanganate ion / *Permanganaat-ioon* ✓ (1)
- 8.4.2 $2\text{MnO}_4^-(\text{aq}) + 16\text{H}^+(\text{aq}) + 10\text{I}^-(\text{aq}) \checkmark \rightarrow 2\text{Mn}^{2+}(\text{aq}) + 5\text{I}_2(\text{s}) + 8\text{H}_2\text{O}(\text{l}) \checkmark$ bal. ✓ (3)
- 8.4.3 $\text{C}(\text{s}) | \text{I}^-(\text{aq}) | \text{I}_2(\text{s}) || \text{H}^+(\text{aq}), \text{MnO}_4^-(\text{aq}), \text{Mn}^{2+}(\text{aq}) | \text{C}(\text{s})$ (3)
- 8.5 $E^\circ_{\text{cell}} = E^\circ_{\text{cathode}} - E^\circ_{\text{anode}} \checkmark$
 $= 1,51 \checkmark - 0,54 \checkmark$
 $E^\circ_{\text{cell}} = 0,97 \text{ V} \checkmark$ (4)
- 8.6 Decreases / *Verlaag* ✓ (1)
- [16]**

QUESTION 9/VRAAG 9

- 9.1 A solution that conducts electricity through the movement of ions. ✓✓
'n Oplossing wat elektrisiteit gelei deur die beweging van ione. (2)
- 9.2 Bracelet / *Armband* ✓ (1)
- 9.3
- 9.3.1 Chromium / *Chroom* ✓ (1)
- 9.3.2 $\text{Cr}^{3+}(\text{aq}) + 3\text{e}^- \rightarrow \text{Cr}(\text{s}) \checkmark \checkmark$ (2)
- 9.4 $n(\text{Cr}) = \frac{m}{M} \checkmark$
 $= \frac{0,86}{52} \checkmark$
 $= 0,0165 \text{ mol}$
 $n(\text{electrons} / \text{elektrone}) = 3n(\text{Cr}) \checkmark = 4,96 \times 10^{-2} \text{ mol}$
 $n = \frac{N}{N_A} \checkmark$
 $4,96 \times 10^{-2} = \frac{N}{6,02 \times 10^{23}}$
 $\therefore N = 2,99 \times 10^{22} \checkmark$ (6)

[12]

QUESTION 10/VRAAG 10

- 10.1 Contact process / *Kontakproses* ✓ (1)
- 10.2 Sulphur dioxide / SO_2 / *Swaweldioksied* ✓ (1)
- 10.3
- 10.3.1 Vanadium pentoxide / Vanadium(V) oxide / V_2O_5 ✓
Vanadiumpentoksied / Vanadium(V)oksied / V_2O_5 (1)
- 10.3.2 $2\text{SO}_2(\text{g}) + \text{O}_2 \rightleftharpoons 2\text{SO}_3$ ✓ Bal. ✓ (3)
- 10.4
- 10.4.1 Oleum / Pyrosulphuric acid / $\text{H}_2\text{S}_2\text{O}_7$ ✓
Oleum / Piroswawelsuur / $\text{H}_2\text{S}_2\text{O}_7$ (1)
- 10.4.2 Reaction is highly exothermic and forms a mist. ✓
Die reaksie is hoog eksotermies en vorm 'n mis. (1)
- 10.5 Ammonium sulphate / $(\text{NH}_4)_2\text{SO}_4$ ✓
Ammoniumsulfaat / $(\text{NH}_4)_2\text{SO}_4$ (1)
- 10.6 Eutrophication leads to the destruction of aquatic life / dead zones. ✓
This results in less income due to selling of food / recreation areas. ✓
Eutrofikasie lei tot die afbreek van waterlewe / dooie sones.
Dit het minder inkomste deur die verkoop van voedsel / ontspanningsareas tot gevolg. (2)

[11]**GRAND TOTAL/GROOTTOTAAL: 150**