Province of the
EASTERN CAPE
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE/*GRAAD* 12

JUNE/*JUNIE* 2016

PHYSICAL SCIENCES P2
FISIESE WETENSKAPPE V2
(CHEMISTRY/*CHEMIE*)
MEMORANDUM

MARKS/*PUNTE*: **150**

This memorandum consists of 7 pages.
Hierdie memorandum bestaan uit 7 bladsye.

QUESTION / *VRAAG* 1

1.1 C√√ 1.2 A √√ 1.3 B√√ 1.4 D√√ 1.5 C√√
1.6 A√√ 1.7 A√√ 1.8 A√√ 1.9 B√√ 1.10 D√√ **[20]**

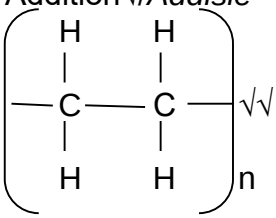
QUESTION / *VRAAG* 2

2.1.1 C_nH_{2n}√ (1)
2.1.2 Ketone√/ *Ketoon* (1)
2.1.3 E√ (Methanal/ *Metanaal*) (1)

2.2.1 Contains double bonds (or multiple bonds) between C atoms. √√
Besit dubbelbindings (meervoudige binding) tussen C atome. (2)

NOTES/*AANTEKENINGE*
2 marks or 0/ *2 punte of 0*

2.2.2 Addition√/*Addisie* (1)

2.2.3  √√ Accept /Aanvaar $+CH_2CH_2+_n$ (2)

2.3.1 2-bromo√-4-methyl√ hexane√
2-broom-4-metielheksaan (3)

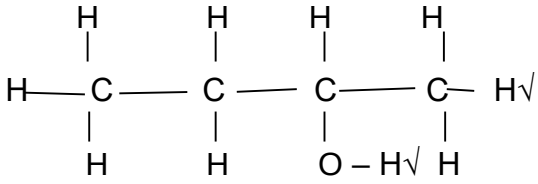
Marking criteria/Nasienriglyne	
2-bromo√ or 2 bromo	*2-broom of 2 broom*
4-methyl√ or 4 methyl	*4-metiel of 4 metiel*
hexane√	heksaan

Any error e.g. omission of hyphens, incorrect order etc.
Enige foute bv. uitlating van koppeltekens, verkeerde orde ens. (2/3)

2.3.2 4-methyl√pentan-2-one√ *Accept* 4-methyl-2-pentanone
4-metielpentan-2-oon Aanvaar 4-metiel-2-pentanoon (2)

Marking criteria/Nasienriglyne	
4-methyl√ or 4 methyl	*4-metiel or 4 metiel*
pentan-2-one√ or pentan 2 one	*pentan-2-oon or pentan 2 oon*

Any error e.g. omission of hyphens, incorrect order etc.
Enige foute bv. weglating van koppeltekens, verkeerde orde ens. (1/2)

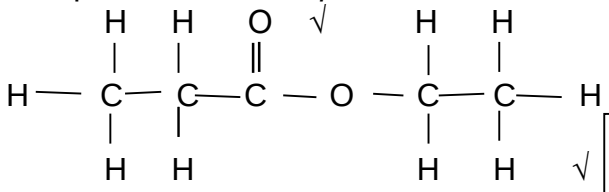
2.4.1  (2)

Marking criteria/Nasienriglyne
Functional group√ /*funksionele groep*
Whole structure correct√ /*Hele struktuur*

2.4.2 2-methyl√propan-2-ol√ *Accept* 2-methyl-2-propanol
2-metiel propan-2-ol Aanvaar 2-metiel-2-propanol (2)

Marking criteria/Nasienriglyne	
2-methyl√	*2-metiel*
propan-2-ol√	*propa-2-ol*

2.5.1 Propanoic acid√ /*Propanoësuur* (1)

2.5.2  (2)

Marking criteria/Nasienriglyne
Functional group√/*Funksionele groep*√
Whole structure correct√/ *Hele struktuur korrek*√

2.6.1 $C_2H_4Br_2$√ (1)

NOTES/ANTEKENINGE
Ignore order of atoms in formula e.g. $C_2Br_2H_4$√
Ignoreer orde van atome in formule bv. $C_2Br_2H_4$√ (1/1)

2.6.2

Positive marking from 2.6.1/*Positiewe nasien vanaf 2.6.1*

% C = (2x12)/188 × 100 √
= 12,76% or/*of* 12,77% √
% H = (4×1)/188 × 100√
= 2,13% or/*of* 2,12%√
% Br = 100 – (12,76 + 2,13) = 85,11%√
OR/OF
% Br = (2×80) /188 × 100
= 85,11% or/*of* 85,10%√ (6)

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QUESTION / *VRAAG* 3

3.1 Positional√ (isomer) /*Posisionele (isomeer)* (1)

3.2.1 Substitution√ /*Substitusie* (1)
3.2.2 Hydrogen bromide√/HBr
Waterstof bromied/HBr (1)

3.3.1 (concentrated) potassium hydroxide√/KOH
(gekonsentreerde) kaliumhidroksied/KOH *(1)*
3.3.2 strong heat√/*sterk hitte* (1)

3.4 Hydration√/Hidrasie (1)

3.5 (concentrated) H_2SO_4√/Sulphuric acid
(gekonsentreerde) H_2SO_4*/Swawelsuur* (1)

3.6 $C_4H_8 + 6O_2$ √ ⟶ $4\ CO_2 + 4H_2O$√ √ Balancing/*Balansering* (3)

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QUESTION / *VRAAG* 4

4.1 **A**√ (Butane/*Butaan*) (1)

4.2 A group of organic compounds with the same functional group√√ / where one member differs from the next member with a $–CH_2–$ group.
'n Groep organiese verbindings met dieselfde funksionele groep / waarin een lid van die volgende verskil met 'n $–CH_2–$ *groep.* (2)

NOTES/*AANTEKENINGE*
2 marks or 0/ *2 punte of 0*

4.3 London force√ /induced-dipole force/dispersion force
London kragte/geïnduseerde-dipool kragte/dispersie kragte (1)

4.4.1 In **A** there are London forces√ /dispersion/induced-dipole forces
In **B** there are dipole-dipole forces √ (in addition to London forces)
Intermolecular forces in **B** are stronger√ than in **A**.OR Intermolecular forces in **A** are weaker than in **B.**
*In **A** is daar London-kragte/dispersie/geïnduseerde-dipool kragte.*
*In **B** is daar dipool-dipool kragte (in addisie met London-kragte)*
*Intermolekulêre kragte in **B** is sterker as in **A**.OF Intermolekulêre kragte in **A** is swakker as in **B**.* (3)

4.4.2 Both **C** and **D** have hydrogen bonds√
Hydrogen bonds are stronger in **D** than **C**√ because **D** has more sites for Hydrogen bonds√ /two sites for hydrogen bonding/ **D** forms dimers/**D** is more polar.
*Beide **C** en **D** het waterstofbindings.*
*Waterstofbindings is sterker in **D** as in **C** omdat **D** meer kante vir waterstofbindings het./twee kante vir waterstofbindings/**D** vorm dimere/**D** is meer polêr.* (3)

4.5.1 **D**√ (Butanoic acid/*Butanoësuur*) (1)
4.5.2 Compound **E** has a larger surface area than **D**√/longer carbon chain length than **D**.
London forces√/induced dipole/dispersion forces in **E** are stronger√ than in **D**.
OR
London forces/induced dipole/dispersion forces in **D** are weaker than in **E**.

*Verbinding **E** het groter oppervlaksarea as D/ langer koolstofketting as **D**.*
*London-kragte/geïnduseerde dipole/ dispersie kragte in **E** is sterker as in **D**.*
OF
*London-kragte/geïnduseerde dipole/ dispersie kragte in **D** is swakker as in **E.***
(3)
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QUESTION / *VRAAG* 5

5.1 HETEROGENEOUS√/*HETEROGEEN* (1)

5.2 CO_2 escapes√/*CO_2 ontsnap* (1)

5.3 t = 5√ (minutes/*minute*) (1)

5.4 Rate/*Reaksietempo* = - $\Delta m/\Delta t$ = -(188,8–192,4) √ /(1-0) √
= 3,6 √ (grams per minute/*gram per minuut*).
Accept/Aanvaar
Rate/Reaksietempo = $\Delta m/\Delta t$ = (188,8–192,4) √ /(1-0) √
= -3,6 √ (grams per minute/*gram per minute*) (3)

5.5 Concentration of the acid decreases√/Surface area of $CaCO_3$ decreases.√
Konsentrasie van die suur neem af/Oppervlakarea van $CaCO_3$ neem af. (2)

5.6 Calcium carbonate√/$CaCO_3$
Kalsiumkarbonaat/$CaCO_3$ (1)

5.7 $m(CO_2) = 192,4 - 186,7 = 5,7\ g$√

$n = m/M = 5,7 / 44$ √ $= 0,13$ mol (0,1295.. mol)

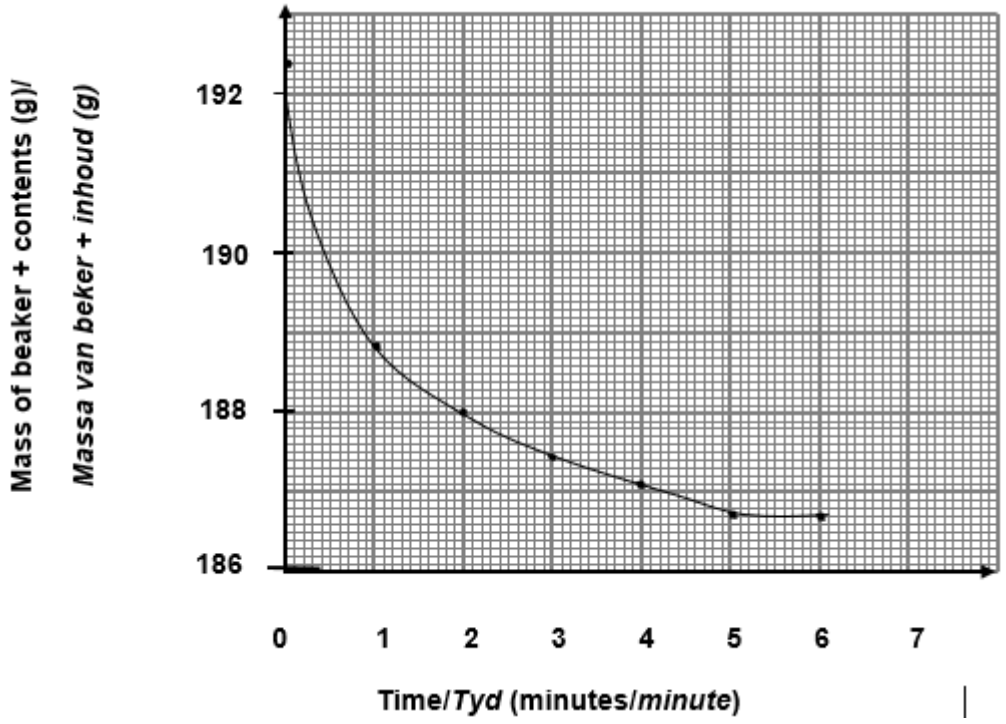
$n(CaCO_3) = n(CO_2) = 0,13$ mol√ (0,1295.. mol)

$m(CaCO_3) = n.M = 0,13 \times 100$ √ $= 13$ g (12,95 g) (5)

Accept Range/*Aanvaar* reikwydte 12,95 g to/*tot* 13 g

5.8

Graph of mass of beaker and contents vs time
Grafiek van massa van beker en inhoud teenoor tyd.



(4)

5.9 Reaction rate increases√
Average kinetic energy of particles increases √ (as temperature increases)
More particles have enough kinetic energy to react√
More effective collisions per unit time√
Reaksietempo neem toe.
Gemiddelde kinetiese energie van partikels neem toe (soos temperatuur toeneem.)
Meer partikels het genoegsame kinetiese energie om te reageer.
Meer effektiewe botsings per eenheidstyd. (4)

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QUESTION / *VRAAG* 6

6.1 Stage reached by a reversible chemical reaction in a closed container where the rate of forward reaction is equal to rate of reverse reaction√√ (2)
'n Stadium bereik deur die omkeerbare chemiese reaksie in 'n geslote houer waar die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie.

Notes/Aantekeninge
2 marks or 0/ *2 punte of 0*

6.2.1 4 √ (minutes/*minute*) (1)

6.2.2 0,5 √ (mol) (1)

6.3 (+) Positive marking from 6.2.2/*Positiewe nasien vanaf 6.2.2*

Marking criteria/*Nasien riglyne*

- division all n by V√/*verdeel alle 'n deur V.*
- K_c expression√/ K_c *uitdrukking*
- substitution for Kc√/*substitusie van* K_c
- substitution of equilibrium concentrations√√/*substitusie van ewewig.*
- final answer√/*finale antwoord*

Concentration at equilibrium/*Konsentrasie by ewewig*

$c(AX_3) = n/V = 0,5/V$
$c(AX_2) = n/V = 0,6/V$
$c(X_2) = n/V = 0,2/V$
} √ (division by V/ *Verdeel deur V*)

$K_c = [AX_2]^2.[X_2] / [AX_3]^2$√
$2,5 \times 10^{-2}$√ $= (0,6/V)^2 . (0,2/V)$ √ $/ (0,5/V)^2$√
$V = 11,52\ dm^3$√ (6)

6.4 Low√ K_c is less than 1 (or K_c is low)
Lae K_c *is kleiner as 1 (of* K_c *is laag*) (2)

6.5 Endothermic√/*Endotermies*
As temperature decreases $[AX_3]$ increases√
Reverse reaction is favoured by decrease in temperature√
Reverse reaction is exothermic√
Soos temperatuur afneem, neem $[AX_3]$ *toe.*
Omkeerbare reaksie word bevoordeel deur afname in temperatuur.
Omkeerbare reaksie is eksotermies. (4)

6.6 Remains constant√/*Bly konstant.* (1)
[17]

QUESTION / *VRAAG* 7

7.1.1 Ionisation constant√ (for an acid)/*Ionisasie konstante (vir 'n suur)* (1)

7.1.2 K_a depends on temperature.√/ K_a *changes as temperature changes*.
K_a *is afhanklik van temperatuur.* √/ K_a *verander as temperatuur verander.* (1)

7.1.3 $H(COO)_2^-$ √ (1)

7.1.4 $(COOH)_2(s) + 2H_2O(\ell)$ √ ⇌ $(COO)_2^{2-}(aq) + 2H_3O^+(aq)$ √
√ Balancing/*Balansering* (3)

Notes/*Aantekeninge*
Ignore phases/*Ignoreer fases*
Ignore type of arrow./*Ignoreer tipe pyltjie*

7.2.1 $n = cV$ √= 1 × 40/1000√ = 0,04 mol

$m = n.M$= 0,04 × 40√ = 1,6 g√ (4)

7.2.2 $n = c.V$√ = 0,06 × 50/1000√ = 0,003 mol√ (3)

7.2.3 + Positive marking from 7.2.1 and 7.2.2/
Positiewe nasien vanaf 7.2.1 en 7.2.2

Marking criteria/Nasienriglyne

- use of ratio $n(H_2SO_4):n(NaOH)$√/*gebruik die verhouding* $n(H_2SO_4):n(NaOH)$
- n(NaOH) in excess $n_{initial} - n_{reacting}$√/ n(NaOH) in oormaat $n_{initial} - n_{reacting}$/
- substituting (90/100) into c = n/V√/ vervang (90/100) in c = n/V/
- $[OH^-].[H_3O^+] = 10^{-14}$√
- substitution for/*vervanging vir* $[OH^-]$√
- $pH = -\log[H_3O^+]$√
- substitution for/*vervanging vir* $[H_3O^+]$√
- final answer/*finale antwoord* √

n(NaOH) initial = 0,04 mol therefore $n(H_2SO_4)$ required = ½ × 0,04 = 0,02 mol
$n(H_2SO_4)$ initial = 0,003 mol

therefore/*dus* n(NaOH)reacting/*reagerend* = 2 × 0,003 = 0,006 mol√

n(NaOH) in excess/*oormaat* = 0,04 - 0,006 = 0,034 mol√

$c = n/V$ = 0,034 / (90/1000) √ = 0,378 mol·dm^{-3}
$[OH^-].[H_3O^+] = 10^{-14}$√
0,378√ × $[H_3O^+] = 10^{-14}$
$[H_3O^+] = 2,65 \times 10^{-14}$
$pH = -\log[H_3O^+]$√
$= -\log 2,65 \times 10^{-14}$√
= 13,58√ (8)

7.3.1 Endpoint√/*Endpunt* (1)
7.3.2 Burette√/*Buret* (1)
7.3.3 To see endpoint clearly.√ *Om die eindpunt duidelik te sien.* (1)

7.3.4 $CH_3COO^- + H_2O$ √ ⇌ $CH_3COOH + OH^-$√ √ balancing/*balansering*
Ethanoate ion reacts with water to form (an excess of) OH^-ions√
Etanoaat-ioon reageer met water om OH^--ione (in oormaat) te vorm. (4)
[28]

QUESTION / *VRAAG* 8

8.1 Activation√ /*Aktiverings*(energy/*energie*) (1)

8.2.1 Exothermic√/*Eksotermies* $\Delta H < 0$ √ / Δ H negative/*negatief* (2)
8.2.2 Increase pressure.√ / Decrease temperature√ / Add more NO or O_2 √
Toename in druk./Afname in temperatuur./Voeg meer NO of O_2 by.
(any 2/*enige 2*) (2)
8.2.3 ΔH = -74,55 √ (1)

8.3.1 Neutralisation√ /Protolysis/Protolytic
Neutralisasie / Protoliese/Protolities (1)
8.3.2 Proton √ (1)
8.3.3 $n(NaOH) = n(NH_4NO_3) = 2,4 \times 10^{-3}$ mol√
$m(NH_4NO_3) = n.M = 2,4 \times 10^{-3} \times 80$√ = 0,192 g
% Purity = 0,192 / 0,204 × 100√ = 94,12 %√ (4)
[12]

TOTAL / TOTAAL: 150