PHYSICAL SCIENCES

MATERIAL FOR GRADE 12

FIRST TERM

ORGANIC CHEMISTRY

MEMORANDA

COMPILED BY EXPERTS: K. NCUBE & T. MJIKWA

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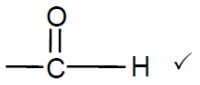
QUESTION 2/*VRAAG 2*

2.1

2.1.1 B ✓ (1)

2.1.2  ✓ (1)

2.1.3 C_nH_{2n-2} ✓ (1)

2.1.4 4-ethyl-5-methylhept-2-yne / 4-ethyl-5-methyl-2-heptyne

4-etiel-5-metielhept-2-yn / 4-etiel-5-metiel-2-heptyn

Marking criteria/*Nasienriglyne:*
- 4-ethyl / *4-etiel* ✓ **OR/*OF*** 4 ethyl / *4 etiel*
- 5-methyl / *5-metiel* ✓ **OR/*OF*** 5 methyl / *5 metiel*
- hept-2-yne / 2-heptyne / *hept-2-yn / 2-heptyn* ✓
  OR/*OF* hept 2 yne / 2 heptyne / *hept 2 yn / 2 heptyn*

IF/*INDIEN:*
Any error e.g. hyphens omitted and/or incorrect sequence:
Enige fout bv. koppeltekens weggelaat en/of verkeerde volgorde: Max./*Maks.* $^2/_3$ (3)

2.1.5 Butan-2-one / 2-butanone / Butanone
Butan-2-oon / 2-butanoon / Butanoon

Marking criteria/*Nasienriglyne:*
- Functional group / *Funksionele groep* ✓
- Whole name correct / *Hele naam korrek* ✓ (2)

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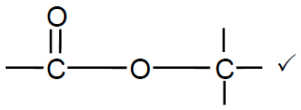
QUESTION 3/*VRAAG 3*

3.1

3.1.1 Esterification / Condensation ✓
Esterifikasie / Verestering / Kondensasie (1)

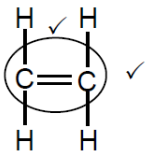
3.1.2  ✓

(1)

3.1.3 Propanoic acid / *Propanoësuur* ✓ (1)

3.1.4 Dehydration / elimination ✓
Dehidrasie / dehidratering / eliminasie (1)

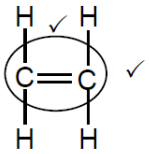
3.1.5 (Concentrated) H_2SO_4 / sulphuric acid / H_3PO_4 / phosphoric acid ✓
(Gekonsentreerde) H_2SO_4 */ / swaelsuur / swawelsuur /* H_3PO_4 / fosforsuur (1)

3.1.6  ✓

Notes/*Aantekeninge*
- Functional group: ✓
  Funksionele groep:
- Whole structure correct: ✓
  Hele struktuur korrek:

(2)

3.2

3.2.1  ✓

Notes/*Aantekeninge*
- Functional group: ✓
  Funksionele groep:
- Whole structure correct: ✓
  Hele struktuur korrek:

(2)

3.2.2 Addition / *Addisie* ✓ (1)

[10]

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QUESTION 4/*VRAAG 4*

4.1 A bond/an atom or a group of atoms ✓ that determine(s) the (physical and chemical) properties of a group of organic compounds. ✓
'n Binding of 'n atoom of 'n groep atome wat die (fisiese en chemiese) eienskappe van 'n groep organiese verbindings bepaal. (2)

4.2

4.2.1 D / ethanoic acid / *etanoësuur* ✓

Lowest vapour pressure. ✓
Laagste dampdruk. (2)

4.2.2 A / butane / *butaan* ✓ (1)

4.3
- Between molecules of **A** / butane / alkanes are London / induced dipole / dispersion forces. ✓
  *Tussen molekule van **A** / butaan / alkane is London / geïnduseerde dipole / dispersiekragte.*
- Between molecules of **B** / propan-2-one / ketones are dipole-dipole forces ✓ in addition to London / induced dipole / dispersion forces.
  *Tussen molekule van **B** / propan-2-oon / ketone is dipool-dipool-kragte tesame met London / geïnduseerde dipool /dispersiekragte.*
- Intermolecular forces in **A** are weaker than those in **B**. / Less energy is needed in **A** to break/overcome intermolecular forces. ✓
  *Intermolekulêre kragte in **A** is swakker as die in **B**./ Minder energie word by **A** benodig om intermolekulêre kragte te breek/oorkom.*

  OR/*OF*

  Intermolecular forces in **B** are stronger than those in **A**. / More energy is needed in **B** to break/overcome intermolecular forces.
  *Intermolekulêre kragte in **B** is sterker as die in **A**. / Meer energie word by **B** benodig om intermolekulêre kragte te breek/oorkom.*

OR/*OF*
- Between molecules of **A** / butane / alkanes are weak London / induced dipole / dispersion forces.
  *Tussen molekule van **A** / butaan/alkane is swak London / geïnduseerde dipool / dispersiekragte.*
- Between molecules of **B** /propan-2-one / ketone are strong(er) dipole-dipole forces in addition to London/induced dipole / dispersion forces.
  *Tussen molekule van **B** / propan-2-oon / ketone is sterk(er) dipool-dipool/dispersiekragte.* (3)

4.4 London forces/dispersion forces/induced dipole forces/dipole-dipole forces. ✓
Londonkragte/dispersiekragte/geïnduseerde dipoolkragte/dipool-dipoolkragte.

OR/*OF*

A and **B** do not have hydrogen bonding./**C** and D have hydrogen bonding.
***A** en **B** het nie waterstofbinding nie./**C** en **D** het waterstofbinding.* (1)

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4.5 **OPTION 1/*OPSIE 1***

- **D** has more sites for hydrogen bonding than **C** / forms dimers / is more polar than **C**. ✓
  ***D** het meer punte vir waterstofbinding as **C** / vorm dimere / is meer polêr as **C**.*
- **D** has stronger / more intermolecular forces / dipole-dipole forces. ✓
  ***D** het sterker / meer intermolekulêre kragte / dipool-dipoolkragte.*

OR/*OF*

D needs more energy to overcome/break the intermolecular forces.
***D** het meer energie nodig om die intermolekulêre kragte te oorkom/breek.*

OPTION 2/*OPSIE 2*

- **C** has less sites for hydrogen bonding than **D**. / **C** does not form dimers / **C** is less polar.
  ***C** het minder plekke vir waterstofbinding as **D**. / **C** vorm nie dimere nie / **C** is minder polêr.*
- **C** has weaker / less intermolecular forces / dipole-dipole forces./ **C** needs less energy to overcome/break intermolecular forces / dipole-dipole forces.
  ***C** het swakker / minder intermolekulêre kragte / dipool-dipoolkragte./ **C** benodig minder energie om intermolekulêre kragte / dipool-dipoolkragte te oorkom/breek.*

(2)

4.6

Marking criteria/*Nasienriglyne*

- Mole ratio for $V(CO_2)$ correctly used. / *Molverhouding vir* $V(CO_2)$ *korrek gebruik.*
- Mole ratio for $V(H_2O)$ correctly used. / *Molverhouding vir* $V(H_2O)$ *korrek gebruik.*
- Mole ratio for $V(O_2$ reacted) correctly used. / *Molverhouding vir* $V(O_2$ *reageer*) *korrek gebruik.*
- $V(O_2$ excess/*oormaat*) = $V(O_2$ initial/*aanvanklik*) – $V(O_2$ change/*verandering*).
- V_{tot} = 80 cm^3

OPTION 1/*OPSIE 1*

$V(CO_2) = 4V(C_4H_{10})$
$= (4)(8)$ ✓
$= 32\ cm^3$

$V(H_2O) = 5V(C_4H_{10})$
$= (5)(8)$ ✓
$= 40\ cm^3$

$V(O_2$ reacted/*reageer*):
$V(O_2) = \frac{13}{2}V(C_4H_{10})$
$= (\frac{13}{2})(8)$ ✓ $= 52\ cm^3$

$V(O_2$ excess/*oormaat):*
$V(O_2) = 60 - 52$ ✓ $= 8\ cm^3$

$V_{tot} = 32 + 40 + 8 = 80\ cm^3$ ✓

OPTION 2/*OPSIE 2*

	C_4H_{10}	O_2	CO_2	H_2O
Initial V (cm^3) *Begin*V (cm^3)	8	60	0	0
Change in V (cm^3) *Verandering* V (cm^3)	8	52 ✓	32 ✓	40 ✓
Final V (cm^3) *Finale* V (cm^3)	0	8 ✓	32	40

Total/*totale* volume = 8 + 32 + 40 = 80 cm^3 ✓

QUESTION 2/*VRAAG 2*

2.1

2.1.1 Ketones/*ketone* ✓ (1)

2.1.2 3,5-dichloro✓-4-methyl✓octane ✓
3,5-dichloor-4-metieloktaan OF 3,5-dichloro-4-metieloktaan

Marking criteria/*Nasienriglyne*
- 3,5-dichloro **OR/*OF*** 3,5 dichloro ✓
- -4-methyl/*-4-metiel* **OR/*OF*** 4 methyl/*4 metiel* ✓
- octane/*oktaan* ✓

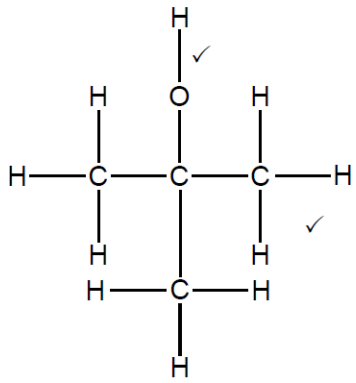
IF/*INDIEN*:

Any error, e.g. hyphens omitted and/or incorrect sequence. Max $\frac{2}{3}$

Enige fout, bv. uitlaat van koppeltekens en/of verkeerde volgorde. Maks $\frac{2}{3}$

(3)

2.1.3



Notes/*Aantekeninge:*
- Functional group (-OH) on **second C atom.** ✓
  *Funksionele groep (-OH) op **tweede C-atoom.***
- Whole structure correct ✓
  Hele struktuur korrek

(2)

2.2

2.2.1 Acts as catalyst./Increases the rate of reaction./Act as dehydrating agent. ✓
Tree as katalisator op./Verhoog die tempo van die reaksie./Tree as dehidreermiddel op. (1)

2.2.2 Water/H_2O ✓ (1)

2.2.3

mol C	:	mol H	:	mol O
$\frac{40}{12}$ ✓	:	$\frac{6,67}{1}$ ✓	:	$\frac{53,33}{16}$ ✓
3,33	:	6,67	:	3,33
1	:	2	:	1 ✓

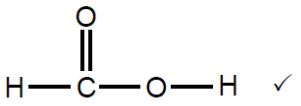
Empirical formula/*Empiriese formule*:
CH_2O ✓ (5)

Marking criteria/*Nasienriglyne*:
- % divide by M(C). ✓
  % gedeel deur M(C).
- % divide by M(H). ✓
  % gedeel deur M(H).
- % divide by M(O). ✓
  % gedeel deur M(O).
- Simplest mole ratio. ✓
  Eenvoudigste molverhouding.
- CH_2O ✓

2.2.4 $M(CH_2O) = 30\ g{\cdot}mol^{-1}$ ✓
Formula-units/*Formule-eenhede*:
$\frac{60}{30} = 2$ ✓
Molecular formula/*Molekulêre formule*: $C_2H_4O_2$ ✓ (3)

Marking criteria/*Nasienriglyne*:
- $30\ (g{\cdot}mol^{-1})$ ✓
- Formula-units = 2 ✓
  Formule-eenhede = 2
- $C_2H_4O_2$ ✓

2.2.5



✓ (1)

Notes/*Aantekeninge*:
- Accept –OH as condensed.
  Aanvaar –OH as gekondenseerd.

2.2.6 Methyl ✓ methanoate ✓ (2)
Metielmetanoaat
[19]

QUESTION 3/*VRAAG 3*

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

3.2 The stronger the intermolecular forces, the higher the boiling point./The boiling point is proportional to the strength of intermolecular forces. ✓
Hoe sterker die intermolekulêre kragte, hoe hoër die kookpunt./Die kookpunt is eweredig aan die sterkte van intermolekulêre kragte.

Notes/*Aantekeninge*: **IF/*INDIEN*** Boiling point is directly proportional to strength of intermolecular forces: *Kookpunt direk eweredig aan sterkte van intermolekulêre kragte:* 0/1

(1)

3.3

3.3.1
- In **A**/propane/alkanes: London forces/dispersion forces/induced dipole forces ✓
  *In **A**/propaan/alkane: Londonkragte/dispersiekragte/geïnduseerde dipoolkragte*
- In **B**/ propan-2-one/ketones: dipole-dipole forces ✓ in addition to London forces/dispersion forces/induced dipole forces
  *In **B**/propan-2-oon/ketone: dipool-dipoolkragte tesame met Londonkragte/ dispersiekragte/geïnduseerde dipoolkragte*
- Intermolecular forces in **A** are weaker ✓than in **B**./Intermolecular forces in **B** are stronger ✓ than in **A**./London forces are weaker than dipole-dipole forces.
  *Intermolekulêre kragte in **A** swakker as in **B**./Intermolekulêre kragte in **B** sterker as in **A**./Londonkragte is swakker as dipool-dipoolkragte.* (3)

3.3.2
- Both **C** and **D**: hydrogen bonding ✓
  *Beide **C** en **D**: waterstofbinding*
- **D** has two/more sites for hydrogen bonding./**D** forms dimers./**D** is more polar./**C** has one/less sites for hydrogen bonding. ✓
  ***D** het twee/meer plekke vir waterstofbinding./**D** vorm dimere./**D** is meer polêr./**C** het een/minder plekke vir waterstofbinding.*
- **D** has stronger intermolecular forces than **C**./**C** has weaker intermolecular forces than **D**. ✓
  ***D** het sterker intermolekulêre kragte as **C**./**C** het swakker intermolekulêre kragte as **D**.* (3)

3.4 Liquid/*Vloeistof* ✓ (1)
[10]

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QUESTION 4/*VRAAG 4*

4.1

4.1.1 Addition/*Addisie* ✓ (1)

4.1.2 Polyethene/polythene/polyethelene ✓
Polieteen/politeen/polietileen (1)

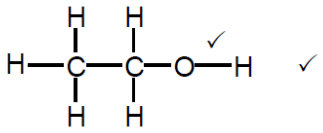
4.2.

4.2.1 Chloro✓ethane✓
Chloroetaan/chlooretaan (2)

4.2.2 Hydrohalogenation/hydrochlorination ✓
Hidrohalogenering/hidrochloronering (1)

4.3

4.3.1



✓ ✓

Notes/*Aantekeninge:*
- Functional group. ✓
  Functional group.
- Whole structure correct ✓
  Hele struktuur korrek

(2)

4.3.2 HCℓ/hydrogen chloride/*waterstofchloried* ✓ (1)

4.4

4.4.1 Saturated/*Versadig* ✓

(-) There are no double/multiple bonds between C atoms./Carbon atoms are bonded to the maximum number of H atoms. ✓
Daar is geen dubbel- of meervoudige bindings tussen C-atome./Koolstof-atome gebind aan maksimum aantal H-atome. (2)

4.4.2 H_2/hydrogen (gas)/*waterstof(gas)* ✓ (1)

4.4.3 $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

Notes/*Aantekeninge*
- Reactants ✓ Products ✓ Balancing ✓
  Reaktanse ✓ *Produkte* ✓ *Balansering* ✓
- Ignore/*Ignoreer* ⇌ and phases/*en fases*
- Marking rule 6.3.10./*Nasienreël 6.3.10.*

(3)

[14]

QUESTION/*VRAAG* 2

2.1 2.1.1 D ✓ or/*of* F (1)

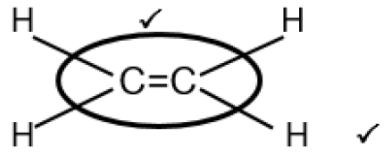
2.1.2 E ✓ (1)

2.2 2.2.1 2,4-dimethyl ✓hex-1-ene ✓/*2,4-dimetielheks-1-een*

Accept/*Aanvaar*: 2,4-dimethyl-1-hexene/*2,4-dimetiel-1-hekseen*

Marking criteria/*Nasienriglyne*:
• Correct stem ie.hex-1-ene/1-hexene./ *Korrekte stam heks-1-een/1-hekseen*. ✓
• Entire name correct./*Hele naam korrek.* ✓

2.2.2



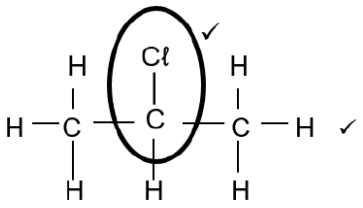
Marking criteria/*Nasienriglyne*:	
• Functional group correct./ *Funksionele groep korrek.*	1/2
• Whole structure correct./ *Hele struktuur korrek*	2/2

(2)

2.3 2.3.1 C_nH_{2n+2} ✓ (1)

2.3.2 CO_2 ✓ and/*en* H_2O ✓ (2)

2.4 2.4.1

2-chloro✓propane✓/ *2-chloorpropaan*	**IF/INDIEN:** 2 chloropropane/*2 chloorpropaan* (1/2)
	**Marking criteria/*Nasienriglyne*:** • Three carbons in longest chain/*Drie koolstowwe in langste ketting.*✓ • Functional group on second carbon/*Funksionele groep op tweede koolstof.*✓
Notes/*Aantekeninge*: Condensed structural formula or semi structural formule./*Gekondenseerde formule of semi-struktuurformule* 1/2 One or more H atoms omitted./Een of meer H atoom weggelaat. 1/2	

(2)(4)

2.4.2 Positional/*Posisioneel*✓ (1)

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2.5

OPTION/*OPSIE* 1

% O = 32 / M × 100 = 12,5 ✓

M = 256 g·mol^{-1}

n(12) + 1(2n) + 32 = 256 ✓ or/*of* n(12) + 1(2n) = 224

n = 16

% C = 16(12)/256 × 100 ✓ = 75 %

X = 75✓

OPTION/*OPSIE* 2

% (H and/*en* C) = 87,5% ✓ (100% - 12,5%)

RATIO/*VERHOUDING* H : C

2n × 1 : n × 12

1 : 6 ✓

%C = 6/7 × 87,5%✓

= 75%✓

(4)

[18]

QUESTION/*VRAAG* 3

3.1 3.1.1 (a) Substitution/*Substitusie* ✓
OR/*OF*
Hydrolysis/*Hidrolise* ✓ (1)

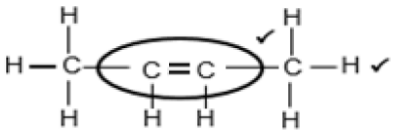
(b) 2-butanol/*butan-2-ol*✓✓

Marking criteria/*Nasienriglyne:*	
Stem i.e. butanol./ *Stam butanol d.i. butanol.*	1/2
Whole name correct./ *Hele naam korrek.*	2/2

(2)

3.1.2 Reaction 2/*Reaksie 2* ✓ (1)

3.1.3

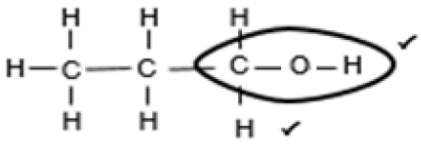


Marking criteria/*Nasienriglyne*:	
• Functional group correct / *Funksionele groep korrek.*	1/2
• Whole structure correct./ Hele struktuur korrek.	2/2

(2)

3.2 3.2.1 To avoid fire./Alcohol catching flame/Alcohol is flammable✓
Om vuur te verhoed./
Om te verhoed dat alkohol vlam vat./Alkohol is vlambaar. (1)

3.2.2



Marking criteria/*Nasienriglyne*:	
• Functional group correct/ *Funksionele groep korrek.*	1 /2
• Whole structure correct./ *Hele struktuur korrek.*	2/2

(2)

3.2.3 Methanoic acid/*Metanoësuur* ✓ (1)

[10]

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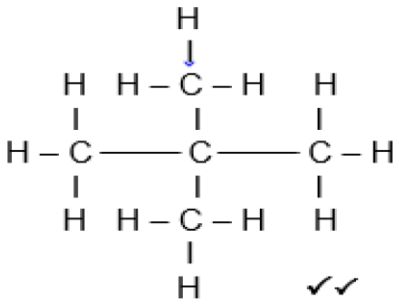
QUESTION/*VRAAG* 4

4.1 Compounds with the same molecular formula ✓ but different length of (carbon) chains.✓
Stowwe met dieselfde molekulêre formule, maar verskillende tipe (koolstof) kettings. (2)

4.2 50✓ (kPa) (1)

4.3



✓✓

Marking criteria/*Nasienriglyne*:
- Three carbons in longest chain/*Drie koolstowwe in langste ketting.*✓
- Two methyl groups on second C atom/*Twee metiel groepe on tweede koolstof.*✓

Notes/*Aantekeninge*:
- Condensed structural or semi-structural formula./*Gekondenseerde struktuur formula of semi-struktuurformule.* (1/2)
- Molecular formula/*Molekulêre formule* (0/2)

(2)

4.4
- Chain in **A** longer than that of in **B**/surface area of **A** larger than that of **B**/**A** is less spherical than **B**. ✓
- Strength of London forces✓/induced dipole/dispersion forces STRONGER in **A** ✓ than in **B**.
- *Ketting in **A** is langer as in **B**/oppervlaksarea in **A** is groter as in **B**/**A** is minder sferies as **B**.*
- *Sterkte van intermolekulêre kragte/Londonkragte/geïnduseerde dipole/dispersie kragte is STERKER in **A** as in **B**.*

OR/*OF*
- Chain in **B** shorter than that in **A**/surface area of **B** smaller than that of **A**/**B** is more spherical than **A**.✓
- Strength of London forces✓/induced dipole/dispersion forces WEAKER in **B** ✓ than in **A**.
- *Ketting in **B** is korter as in **A**./oppervlaksarea in **B** is kleiner as in **A**/**B** is meer sferies as **A**.*
- *Sterkte van intermolekulêre kragte/Londonkragte/geïnduseerde dipole/dispersie kragte is SWAKKER in **B** as in **A**.* (3)

4.5 4.5.1 London forces/induced dipole forces/dispersion forces.✓
Londonkragte/geïndudeerde dipool kragte/dispersie kragte (2)

4.5.2 Between molecules of **D** there are hydrogen bonds ✓ in addition to dipole-dipole forces and London forces/dispersion forces/induced dipole forces.
Between molecules of **F** there are dipole dipole forces ✓in addition to London forces/dispersion forces/induced dipole forces.
Hydrogen bonds in **D** are stronger ✓ than dipole-dipole forces in **F**.
OR
Dipole-dipole forces in **F** are weaker than hydrogen bonds in **D**.

*Tussen molekules van **D** is daar waterstofbindings asook dipool-dipool kragte en Londonkragte/dispersiekragte /geïnduseerde dipoolkragte.*
*Tussen molekules van **F** is daar dipool-dipoolkragte kragte asook Londonkragte/dispersiekragte /geïnduseerde dipoolkragte.*
*Waterstofbindings in **D** is sterker as die dipool-dipool kragte in **F**.*
OF
*Dipool-dipool kragte in **F** is swakker as waterstofbindings in **D**.* (3)

4.5.3 Substitution/Halogenation/Chlorination✓
Substitusie/Halogenasie/Chlorinasie (1)

4.5.4

Marking criteria/*Nasienriglyne*:
*Divide by 22,4./*Deel deur 22,4.*✓
*Use of ratio./*Gebruik verhoudings.*✓
*Divide or multiply by 85./*Deel of vermenigvuldig deur 85.*✓
% yield/% opbrengs.*✓
*Final answer./*Finale antwoord.*✓

OPTION/*OPSIE 1*
$n(CH_4) = V/V_m$ = 26,88/22,4✓ = 1,2 mol

$n(CH_2C\ell_2)$ = 1,2 mol (Ratio/*Verhouding*)✓
$n(CH_2C\ell_2)$actual/werklike = m/M = 0,043 × 10^3/85✓ = 0,506 mol
% Yield = Actual yield/Theoretical yield × 100
% Opbrengs = Werklike opbrengs/Teoretiese opbrengs × 100
= 0,506/1,2 × 100✓
= 42,16%✓

Accepted range/*Aanvaarde wydte*: 42,16 to/*tot* 42,5%

OPTION/*OPSIE 2*
$n(CH_4) = V/V_m$ = 26,88/22,4✓ = 1,2 mol
$n(CH_2C\ell_2)$ = 1,2 mol (Ratio)✓
$(CH_2C\ell_2)$ = nM = 1,2 × 85✓ =102 g
% Yield = Actual yield/Theoretical yield × 100
% Opbrengs = Werklike opbrengs/Teoretiese opbrengs × 100
= 0,043 x10^3/102 × 100✓
= 42,16%✓
Accepted range/*Aanvaarde wydte:* 42,16 to/*tot* 42,5%

OPTION/*OPSIE 3*
$V(CH_2C\ell_2)$ = 26,88dm^3 (Ratio/Verhouding)✓
$n(CH_2C\ell_2)$ = m/M = 0,043 x10^3 /85✓ = 0,506 mol
$V(CH_2C\ell_2) = nV_m$ = 0,506 × 22,4✓ = 11,33 dm^3
% Yield = Actual yield/Theoretical yield × 100
%Opbrengs = Werlikeopbrengs/Teoretiese opbrengs
= 11,33/26,88 × 100✓
= 42,16%✓
Accepted range/*Aanvaarde wydte*: 42,16 to/*tot* 42,5%

(5)
[19]

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QUESTION/VRAAG 2

2.1.1 B ✓ (1)

2.1.2 F ✓ (1)

2.2.1 pentan-2-one ✓✓ /pentan-2-oon

Accept /*Aanvaar :* 2-pentanone/*2-pentanoon*
IF/*AS* pentanone/*pentanoon* one mark/*een punt* (2)

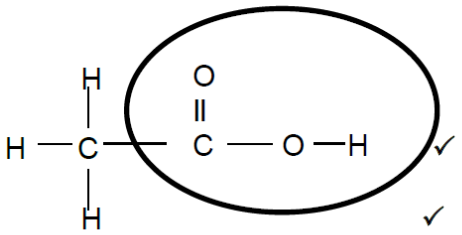
2.2.2 3-bromo-3,4-dimethylhexane/*3-broom-3,4-dimetielheksaan*

Marking criteria/*Nasienriglyne*:
- Correct stem i.e.hexane ✓ I*Korrekte stam d.i. heksaan*
- First substituent, bromo, correctly identified ✓
  Eerste substituent, broom korrek geidentifiseer.
- Second substituent, dimethyl, correctly identified ✓
  Tweede substituent, dimetiel, korrek geidentifiseer.
- Subtract a mark for missing hyphens, commas ,incorrect numbering.
  Trek 'n punt af vir enige koppelteken, komma, verkeerde nommering.

(3)

2.3.1 Ester ✓ (1)

2.3.2

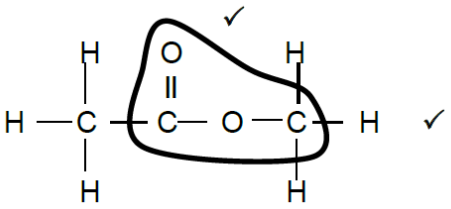


✓ ✓

Marking criteria/*Nasienriglyne:*
- Functional group correct./
  Funksionele groep korrek 1/2
- Whole structure correct./
  Hele struktuur korrek. 2/2

(2)

2.3.3



✓ ✓

Marking criteria/Nasienriglyne:
- Functional group correct./
  Funksionele groep korrek 1/2
- Whole structure correct./
  Hele struktuur korrek. 2/2

(2)

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2.4.1 Organic molecules with the same molecular formula ✓ but different structural formulae. ✓
Organiese molekules met dieselfde molekulêre formule, maar verskillende struktuurformules. (2)

2.4.2 Ethyl ✓ methanoate ✓ / *Etielmetanoaat* (2)

2.5.1 Thermal ✓/*Termiese* (1)

2.5.2 C_4H_{10} ✓ (1)
[16]

QUESTION/*VRAAG 3*

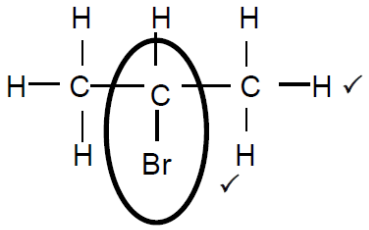
3.1 Secondary ✓/*Sekondêre* (1)

3.2 3.2.1 Substitution ✓/*Substitusie* (1)

3.2.2 Elimination ✓/dehydrohalogenation
Eliminasie /dehidrohalogenering (1)

3.2.3 Addition ✓/hydration
Addissie/hidrasie (1)

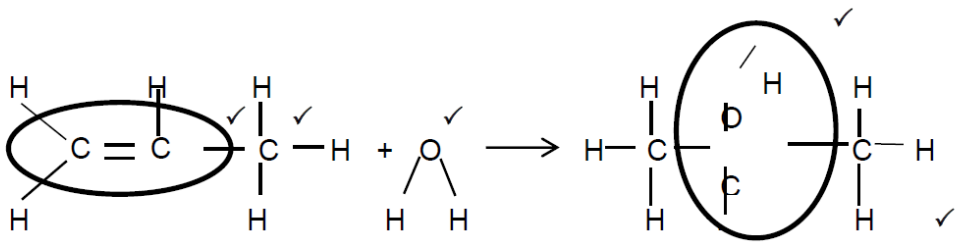
3.3



Marking criteria/Nasienriglyne:
- Functional group correct
  Funksionele groep korrek. 1/2
- Whole structure correct./
  Hele struktuur korrek. 2/2

(2)

3.4



Accept/Aanvaar H_2O

(5)

3.5 Concentrated ✓/*Gekonsentreerd* (1)
[12]

QUESTION/*VRAAG 4*

4.1.1 The pressure exerted by a vapour at equilibrium with its liquid in a closed system. /*Die druk uitgeoefen deur 'n damp wat in ewewig met sy vloeistof in 'n geslote sisteem is.* ✓✓ **(2 OR/*OF* 0)** (2)

4.1.2 Molecular mass (size) ✓/*Molekulêre massa (grootte)* (1)

4.1.3 **E** has two sides for hydrogen bonding and **F** has one **OR E** forms dimers ✓
***E** het twee kante vir waterstofbindings en **F** het een **OF E** vorm dimere.* (1)

4.2.1 **From A to C/*Van A na C***
Chain length decreases/surface area decreases/More branches. ✓
Strength of intermolecular forces/London forces/dispersion forces/induced-dipole forces decreases. ✓
Less energy needed to overcome/break intermolecular forces. ✓

Kettinglengte neem af/oppervlaksarea neem af/Meer vertakkings.
Sterkte van intermolekulêre kragte/London kragte/dispersie kragte/geïnduseerde-dipool kragte neem af.
Minder energie word benodig om die intermolekulêre kragte te oorkom/breek.
OR/*OF*

From C to A/*Van C na A*
Chain length increase/surface area increases/Less branches. ✓
Strength of intermolecular forces /London forces/dispersion forces/induced-dipole forces increases✓
Less energy needed to overcome/break intermolecular forces increases. ✓

Kettinglengte neem toe/oppervlaksarea neem toe/Minder vertakkings.
Sterkte van intermolekulêre kragte /London kragte/dispersie kragte/ geïnduseerde-dipool kragte neem toe.
Meer energie word benodig om die intermolekulêre kragte te oorkom/breek. (3)

4.2.2 Surface area ✓ /Position of side (methyl) chain
Oppervlaks area/ Posisie van sy-(metiel)-ketting (1)

4.2.3 $n(O_2) = V/V_m$
$= 96/24$ ✓
$= 4$ mol
↘
$n(C_6H_{14}) = 2/19 \times 4$ ✓
$= 0,42$ mol

Marking Criteria/Nasienriglyne
- Divide by/Verdeel deur 22,4✓
- Use ratio/Gebruik verhoudings✓
- Multiply by/*Vermenigvuldig met* 4163✓
- Final answer/Finale antwoord✓

Net energy released/ *Netto energie vrygestel* $= 0,42 \times -4163$ ✓ $= -1\,748$ kJ/mol ✓

NOTE/*NOTA*: Accept positive answer/*Aanvaar positiewe antwoord.* (4)

[12]

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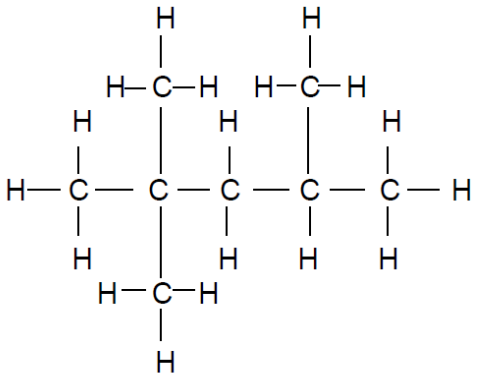
QUESTION/*VRAAG* 2

2.1.1 Alkanes ✓/*Alkane* (1)

2.1.2



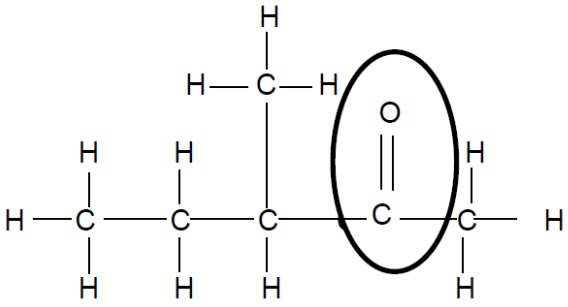
Marking criteria/*Nasienriglyne*:
- Correct stem i.e pentane./ *Korrekte stam d.i.pentaan.*✓
- Three methyl substituents *Drie metielsubstituente.*✓
- Whole structure correct./ *Hele struktuur korrek.* ✓ **3/3**

(3)

2.1.3 CO_2 ✓ and/*en* H_2O ✓ (2)

2.2.1 Compounds with the same molecular formula, ✓ but different positions of the functional group. ✓ / *Verbindings met dieselfde molekulêre formule, maar verskillende posisies van die funksionele groep.* (2)

2.2.2



Marking criteria/Nasienriglyne:
- Correct functional group./ *Korrekte funksionele groep.*✓
- Whole structure correct./ *Hele struktuur korrek.* ✓ **2/2**

3-methyl ✓pentan-2-one ✓/ 3-methyl-2- pentanone
3-metiel ✓pentan-2-oon ✓/ 3-metiel-2- pentanoon (4)

2.3.1 2-chloro-3,4-dimethylhexane / *2-chloor-3,4-dimetielheksaan*

Marking criteria/*Nasienriglyne*:
- Correct stem i.e.hexane ✓ *Korrekte stam d.i. heksaan*
- First substituent, chloro, correctly identified ✓ *Eerste substituent, chloor korrek geïdentifiseer.*
- Second substituent, dimethyl, correctly identified ✓ *Tweede substituent, dimetiel, korrek geïdentifiseer.*
- Subtract a mark for missing hyphens, commas, incorrect numbering. *Trek 'n punt af vir enige koppelteken, komma wat uitgelaat is, verkeerde nommering.*

(3)

2.3.2 SECONDARY ✓ / SEKONDÊR (1)

[16]

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QUESTION/*VRAAG* 3

3.1 They are organic compounds that contain hydrogens and carbons only.✓✓
Hulle is organiese verbindings wat slegs uit waterstof- en koolstofatome bestaan. **(2 or/*of* 0)** (2)

3.2 53,3 ✓ (kPa)

From A to C/*Van A na C*
Chain length decreases/surface area decreases/more branches. ✓
Strength of intermolecular forces/London forces/dispersion forces/induced-dipole forces decreases. ✓
Less energy needed to overcome/break intermolecular forces. ✓

Kettinglengte neem af/oppervlaksarea neem af/meer vertakkings. Sterkte van intermolekulêre kragte/Londonkragte/dispersiekragte/geïnduseerde-dipool kragte neem af.
Minder energie word benodig om die intermolekulêre kragte te oorkom/breek.

OR/*OF*

From C to A/*Van C na A*
Chain length increases/surface area increases/less branches. ✓
Strength of intermolecular forces/London forces/dispersion forces/induced-dipole forces increases. ✓
More energy needed to overcome/break intermolecular forces. ✓

Kettinglengte neem toe/oppervlaksarea neem toe/minder vertakkings.
Sterkte van intermolekulêre kragte/Londonkragte/dispersiekragte/ geïnduseerde-dipool kragte neem toe.
Meer energie word benodig om die intermolekulêre kragte te oorkom/breek. (4)

3.3 **E** ✓ (1)

3.3.1 Compound with lowest vapour pressure ✓
Verbinding met die laagste dampdruk (1)

3.3.2
- Compound **D**(ethanol) has one site for hydrogen bonding, whereas compound **E**(methanoic acid) has two sites for hydrogen bonding. ✓
  Verbinding D(etanol) het een punt vir waterstofbindings, waar verbinding E(metanoësuur) twee punte het vir waterstofbindings.
- Compound **E** has stronger hydrogen bonds than compound **D.** ✓
  *Verbinding **E** het sterker waterstofbindings as verbinding **D.***

(2)
[10]

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QUESTION/*VRAAG* 4

4.1 Substitution ✓/*Substitusie* (1)

4.2.1 Waft your hand across the beaker/test tube toward your nose and sniff/smell (cautiously).✓*I*
Waai met jou hand oor die beker of proefbuis en ruik (versigtig).

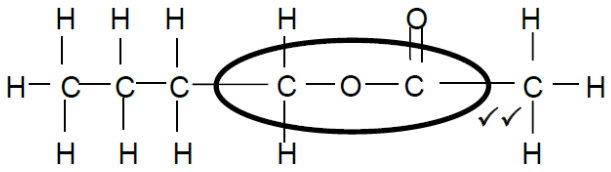
OR/*OF*

Pour the ester into a bowl of water and this will help you to identify the smell of the ester./ *Gooi die ester in 'n glasbak met water om die reuk van die ester te kan identifiseer.* (1)

4.2.2 Esterification ✓/*Esterifikasie* (1)

4.2.3 Ethanoic acid ✓✓*IEtanoësuur* (2)

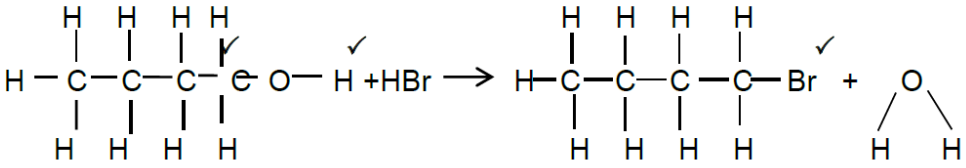
4.2.4



Marking criteria/Nasienriglyne:
- Functional group correct. *Funksionele groep korrek* 1/2
- Whole structure correct. *Hele struktuur korrek.* 2/2

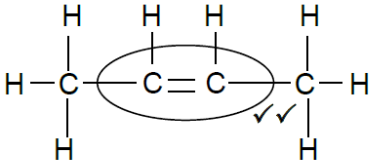
(2)

4.3



Accept/*Aanvaar*: H_2O (4)

4.4.1



Marking criteria/Nasienriglyne:
- Correct functional group. *Korrekte funksionele groep.*✓ **1/2**
- Whole structure correct. *Hele struktuur korrek.* ✓ **2/2**

(2)

4.4.2 Concentrated H_2SO_4/Sulphuric acid ✓
Gekonsentreerde H_2SO_4/Swaelsuur (1)

4.4.3 (Excess) water/H_2O ✓*I* Concentrated H_2SO_4
(Oormaat) water/H_2O /Gekonsentreerde H_2SO_4 (1)
[15]

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