GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION
JUNIE EKSAMEN

GRADE/*GRAAD* 12

2023

MARKING GUIDELINES/
NASIENRIGLYNE

PHYSICAL SCIENCES: CHEMISTRY/
FISIESE WETENSKAPPE: CHEMIE

(PAPER/*VRAESTEL* 2)

12 pages/*bladsye*

QUESTION/*VRAAG* 1: MULTIPLE-CHOICE QUESTIONS/ *MEERVOUDIGEKEUSE-VRAE*

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

QUESTION/*VRAAG* 2

2.1 A hydrocarbon with multiple bonds between the carbon atoms ✓✓ (2 or nothing)

'n Koolwaterstof waarin meervoudige bindings tussen koolstofatome in hul koolwaterstofkettings voorkom. (2 of niks) (2)

2.2 2.2.1 B ✓ (1)

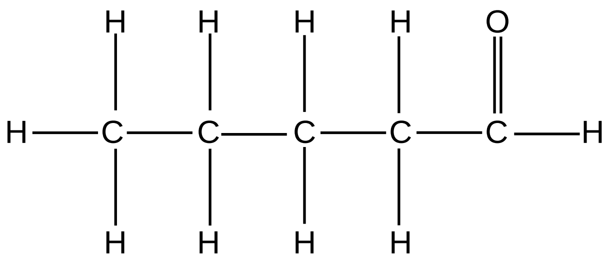
2.2.2 The reddish brown ✓ Br_2 solution will change to colourless. ✓

Die rooibruin ✓ *Br_2-oplossing sal na kleurloos verander.* ✓ (2)

2.3 2.3.1 2,4 – dimethylhex-1-ene ✓✓/*2,4-dimetielheks-1-een*

Marking guide/*Nasienriglyn*
✓ dimethyl and hexane/*dimetiel en hekseen*
✓ numbers, commas, hyphens/*nommers, kommas, koppeltekens* (2)

2.3.2



Marking guideline/ *Nasienriglyn*
✓ functional group/ *funksionele groep*
✓ whole structure/ *hele struktuur*
(2)

2.3.3 Formyl group ✓/*formielgroep* (1)

2.3.4 Ester ✓ (1)

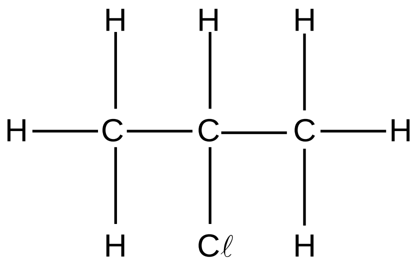
2.4 2.4.1 C_nH_{2n+2} ✓ (1)

2.4.2 CO_2 ✓ and/*en* H_2O ✓ (2)

2.5 2.5.1 The halogen is bonded to a carbon that is bonded to one other carbon. ✓✓ (2 or nothing)

Die halogeen is gebind aan 'n koolstof wat aan een ander koolstof verbind is. (2 of niks) (2)

2.5.2



2-chloropropane/*2-chloropropaan* ✓✓ (2)

2.5.3 positional✓/*posisioneel* (1)

2.6 **Option/*Opsie* 1**

$\%O = \frac{m}{M} \times 100$ ✓

$12,5 = \frac{2x16}{M} \times 100$

$M = 256\ g.mol^{-1}$

$12n + 2n(1) + 32 = 256$ ✓

$n = 16$

$\%C = \frac{m}{M} \times 100$

$x = \frac{12x16}{256} \times 100$✓

$x = 75\%$ ✓

Option/*Opsie* 2

$100 – 12,5 = 87,5\ \%$ ✓

C : H

12n : 2n x 1 ✓

6:1

$\%\ C = \frac{6}{7} x\ 87,5$✓

$x = 75\%$ ✓

(4)

[23]

QUESTION/*VRAAG* 3

3.1 The temperature where the vapour pressure is equal to the atmospheric pressure. ✓✓ (2 or nothing)

Die temperatuur waar die dampdruk gelyk is aan die atmosferiese druk. (2 of niks) (2)

3.2 $CH_3C\ell$ ✓ and/*en* CH_3F✓
They are gases at room temperature✓, very dangerous to inhale.

Hulle is gasse by kamertemperatuur, baie gevaarlik om in te asem. (3)

3.3
- As the strength of the intermolecular forces increase, the boiling point increases. ✓
- Compound E to H all contain dipole-dipole forces between their molecules but the strongest intermolecular force is H, then G then F then E ✓ **OR** Intermolecular forces increase from top to bottom in the table with E and F having dipole-dipole forces and G and H having hydrogen bonds, with G having site for one hydrogen bond and H having sites for two hydrogen bonds.
- More energy is required to overcome the stronger intermolecular forces and therefore ✓
- the boiling points become higher lower down the table. ✓ **OR** the boiling points increase from E to H in the table, **OR** boiling points increase from top to bottom of the table.

- *Soos die sterkte van die intermolekulêre kragte toeneem, neem die kookpunt toe.*
- *Verbindings E tot H bevat almal dipool-dipoolkragte tussen hul molekule maar die sterkste intermolekulêre krag is H, dan G dan F dan E* ***OF*** *Intermolekulêre kragte neem toe van bo na onder in die tabel met E en F wat dipool-dipoolkragte het en G en H wat waterstofbindings het, met G wat plek vir een waterstofbinding het en H met plekke vir twee waterstofbindings.*
- *Meer energie word benodig om die sterker intermolekulêre kragte te oorkom en daarom*
- *Word die kookpunte hoër laer af in die tabel.* ***OF*** *Die kookpunte neem toe van E na H in die tabel,* ***OF*** *Kookpunte neem toe van bo na onder in die tabel.* (4)

3.4 3.4.1 As the number of Cℓ -atoms increase, the boiling point increases. ✓✓

Soos die getal Cℓ-atome verhoog, sal die kookpunt verhoog. (2)

3.4.2
- Because $CC\ell_4$ has a <u>larger surface area/increasing molecular mass</u> than $CH_3C\ell$, this causes more intermolecular forces ✓
- The intermolecular forces are stronger in $CC\ell_4$ than in $CH_3C\ell$ ✓
- <u>More energy needed to overcome intermolecular forces in</u> $CC\ell_4$ ✓

- *Omdat $CC\ell_4$ <u>'n groter oppervlakte het/toenemende molekulêre massa</u> as $CH_3C\ell$, veroorsaak dit meer intermolekulêre kragte* ✓
- *Die intermolekulêre kragte is sterker in $CC\ell_4$ as in $CH_3C\ell$* ✓
- *<u>Meer energie word benodig om intermolekulêre kragte te oorkom</u> $CC\ell_4$* ✓ (3)

3.4.3 1. The type of halogen group✓
2. The number of carbons in the chain✓

1. Die tipe halogeengroep ✓
2. Die aantal koolstofstowwe in die ketting ✓ (2)

3.5 The pressure exerted by a vapour at equilibrium with its liquid in a closed system (2 ✓✓ or nothing)

Die druk uitgeoefen deur 'n damp in ewewig met sy vloeistof in 'n geslote sisteem (2 of niks) (2)

3.6 3.6.1 Methanoic acid ✓/*metanoësuur* (1)

3.6.2
- Methanol and methanoic acid both have hydrogen bonds but methanoic acid has two sites compared to methanol's one site for hydrogen bonds. ✓
- The intermolecular forces of methanoic acid are therefore stronger than methanol. ✓
- More energy is required to overcome these force therefore the vapour pressure is lower. ✓

- *Metanol en metanoësuur het albei waterstofbindings, maar metanoësuur het twee plekke in vergelyking met metanol se een plek vir waterstofbindings.* ✓
- *Die intermolekulêre kragte van metanoësuur is dus sterker as metanol.* ✓
- *Meer energie is nodig om hierdie kragte te oorkom, daarom is die dampdruk laer.* ✓ (3)

[22]

QUESTION/*VRAAG* 4

4.1 4.1.1 Esterification ✓ or condensation/*Verestering of Esterifikasie of kondensasie* (1)

4.1.2 Do not heat alcohol over an open flame (since it is flammable). ✓
OR Heat the alcohol in a water bath.

Moenie alkohol oor 'n oop vlam verhit nie (aangesien dit vlambaar is).
OF *Verhit die alkohol in 'n waterbad.* (1)

4.1.3 Ethyl ✓ propanoate ✓/*etiel propanoaat* (2)

4.1.4 $n_{C_5H_{10}O_2} = \frac{m}{M}$

$= \frac{68,88}{102}$ ✓

= 0,675 mol

$n_{C_2H_6O} = n_{C_5H_{10}O_2}$ = 0,675 mol ✓

m = nxM

= 0,675 x 46 ✓

= 31,05g

%purity = $\frac{m_{actual}}{m_{theory}} x100$

$= \frac{31,05}{50} x100$✓

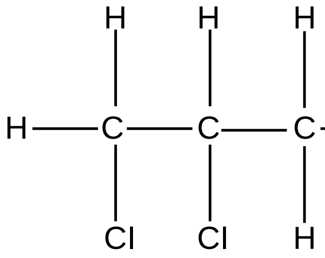
= 62,1% ✓ (5)

<u>Marking guideline</u>
- Substitute mass and molar mass
- Mole ratio
- Multiply n with 46
- Express m/50 x 100
- Answer

<u>Nasienriglyn</u>
- *Vervang mass en molêre massa*
- *Mol verhouding*
- *Vermenigvuldig met 46*
- *Uitdrukking m/50 x 100*
- *Antwoord*

4.2 4.2.1 Reaction I = Addition ✓/*Addisie*
Reaction II = Substitution ✓/*substitusie* (2)

4.2.2



✓ 1,2-dichloropropane/*1,2-dichloropropaan* ✓ (2)

4.2.3 Heat or Light ✓/*Hitte of lig* (1)

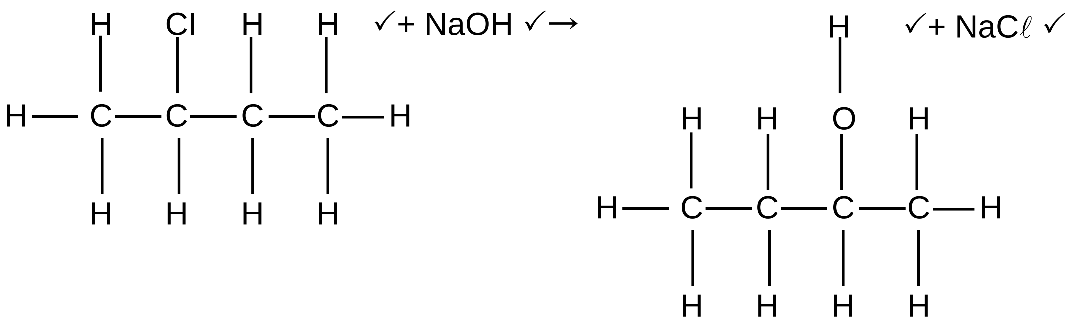
4.2.4 butane ✓/*Butaan* (1)

4.2.5 Hydrogen chloride **OR** HCℓ ✓/*Waterstofchloried* ***OF*** HCℓ ✓ (1)

4.3 4.3.1 Elimination ✓/*Eliminasie* (1)

4.3.2 but-2-ene ✓✓/*but-2-een* (2)

4.3.3



(4)

4.3.4 Hydrolysis✓/*Hidrolise* (1)

[24]

QUESTION/*VRAAG* 5

5.1 Exothermic ✓/*Eksotermies*
Heat of reaction is less than zero. ✓/*Reaksiewarmte is kleiner as nul.* (2)

5.2 Downward displacement of water ✓
OR Gas pushes water down in the cylinder as it moves up in the cylinder.

Afwaartse verplasing van water ✓
OF *Die gas druk water in die silinder af terwyl dit in die silinder opbeweeg*. (1)

5.3 5.3.1 Rate of reaction/*Tempo van reaksie* = $\frac{\Delta n}{\Delta t}$

$-7,5 \times 10^{-4} = \frac{0-n_i}{60-0}$ ✓✓

n = 0,045 mol

$c = \frac{n}{V}$ ✓

$1,5 = \frac{0,045}{V}$✓

V = 0,03 dm^3 thus 30 cm^3✓ (5)

5.3.2 Increases ✓/*Verhoog* (1)

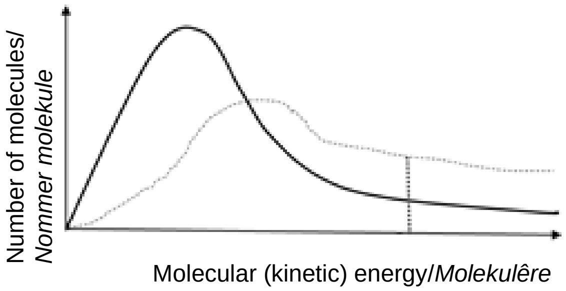
5.3.3
- The reaction is exothermic so the temperature will increase which will increase the kinetic energy of the particles. ✓
- More molecules have enough/sufficient kinetic energy. ✓
- More effective collisions per unit time. ✓

- *Die reaksie is eksotermies so die temperatuur sal toeneem soos die kinetiese energie van die deeltjies verhoog.* ✓
- *Meer molekules het genoeg/voldoende kinetiese energie.* ✓
- *Meer effektiewe botsings per tydseenheid.* ✓ (3)

5.3.4 The graph is a straight line. ✓
The reaction ran to completion **OR** Some of the reactants are depleted. ✓

Die grafiek is 'n reguitlyn. ✓
Die reaksie het tot voltooiing geloop ***OF*** *Sommige van die reaktante is uitgeput.* ✓ (2)

5.4 5.4.1



<u>Marking guideline/</u>
<u>*Nasienriglyn*</u>

- Dotted line highest point below solid line/*hoogste punt van stippellyn onder soliede lyn* ✓
- E_A at same place/E_A *by dieselfde plek* ✓
- Dotted line above solid line after E_A /*stippellyn bo soliede lyn na* E_A ✓

(3)

5.4.2
- The position of the activation energy moves to the left since activation energy becomes lower. ✓
- More particles will have sufficient energy. ✓
- More effective collisions per unit time. ✓

- *Die posisie van die aktiveringsenergie beweeg na links aangesien aktiveringsenergie laer word.* ✓
- *Meer deeltjies sal genoeg energie hê.* ✓
- *Meer effektiewe botsings per tydseenheid.* ✓

(3)
[20]

QUESTION/*VRAAG* 6

6.1 When the equilibrium in a closed system is disturbed, the system will re-instate a new equilibrium by favouring the reaction that will oppose the disturbance. (2 ✓✓ or nothing)

*Wanneer die ewewig in 'n geslote sisteem versteur word, sal die stelsel 'n nuwe ewewig herstel deur die reaksie te bevoordeel wat die versteuring sal teenstaan. (*2 ✓✓ of nul) (2)

6.2 When equilibrium is reached the rate of the forward reaction equals the rate of the reverse reaction ✓ so the rate of the exothermic reaction is the same as the endothermic reaction. ✓

Wanneer ewewig bereik word, is die tempo van die voorwaartse reaksie gelyk aan die tempo van die terugwaartse reaksie ✓ *dus is die tempo van die eksotermiese reaksie dieselfde as die endotermiese reaksie.* ✓ (2)

6.3 No effect ✓/*Geen effek* (1)

6.4 Concentration of NH_3 decreases ✓
A temperature increase favours an endothermic reaction. ✓
The reverse (endothermic) reaction will therefore be favoured. ✓

Konsentrasie van NH_3 neem af ✓
'n Temperatuurverhoging bevoordeel 'n endotermiese reaksie. ✓
Die omgekeerde (endotermiese) reaksie sal dus bevoordeel word. ✓ (3)

6.5 $K_c = \frac{[NH_3]^2}{[N_2][H_2]^3}$ ✓

$4{,}96 = \frac{(0{,}28)^2}{[N_2](0{,}16)^3}$ ✓

$\therefore [N_2] = 3{,}86\ mol.dm^3$ ✓ (3)

6.6 Positive marking from/*Positiewe nasien vanaf* 6.5

$c = \frac{n}{V}$

$3{,}86 = \frac{n}{0{,}5}$ ✓

n = 1,93 mol N_2

Marking guideline/*Nasienriglyn*
- Substitute the c and V ✓/*Substituut die c en V*
- mol at equilibrium ✓/*mol by ewewig*
- changed moles ✓/*veranderde mol*
- ratio 2:1 ✓/*verhouding* 2:1
- $n_{eq} + n_{changed} = n_{initial}$ ✓/
- M = 28 in m = nxM ✓
- Answer/*Antwoord* 56g ✓

(7)

	N_2	H_2	NH_3
Ratio/*Verhouding*	1	3	2
Initial mol/*Aanvankllike mol*	2 ✓	0,29	0
Change in mol/*Verandering in mol*	–0,07 ✓	–0,21	+0,14 ✓
Equilibrium/*Ewewig*	1,93	0,8	0,14 ✓

m = nxM

= 2 x 28 ✓

= 56g of N_2 ✓ **[18]**

QUESTION/*VRAAG* 7

7.1 Acid is a proton donor. (2 ✓✓ or nothing)/*Suur is ŉ protonskenker. (2 of niks)* (2)

7.2 7.2.1 H_2SO_4 ✓
More ions when completely ionised ✓/*Meer ione wanneer volledig geïoniseer*
It is a strong acid which ionises completely./*Dit is ŉ sterk suur wat volledig ioniseer.* (2)

7.2.2 $H_2SO_4 + H_2O \leftrightarrows HSO^-_4 + H_3O^+$

OR/*OF* reactant ✓ products ✓ balance ✓

$H_2SO_4 + 2H_2O \leftrightarrows SO^{-2}_4 + H_3O^+$
Reaktante ✓produkte ✓gebalanseer ✓ (3)

7.3 7.3.1 A solution with a known concentration✓✓/*ŉ Oplossing met ŉ bekende konsentrasie* (2)

7.3.2 pH= -log[H_3O^+] ✓
0,22 ✓ = -log[H_3O^+]
[H_3O^+] = 0,60 mol.dm^{-3}

K_w = [H_3O^+][OH^-] ✓
1 x 10^{-14} = 0,60[OH^-] ✓
[OH^-] = 1,67 x 10^{-14} mol.dm^{-3} ✓ (5)

7.3.3 Positive marking from/*Positiewe nasien vanaf* 7.3.3
$c_{(H2SO4)}$ = 2x[H_3O^+]
= 1,2 mol.dm^{-3}✓

$$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b} \checkmark$$

$$\checkmark \frac{(1,2)20}{c_b 30} = \frac{1}{2}\checkmark$$

c_b = 1,6 mol.dm^{-3}✓ (5)

7.4 7.4.1 Yellow✓/*Geel* (1)

7.4.2 $NH^+_4 + H_2O \leftrightarrows NH_3 + H_3O^+$✓✓
The solution will be acid due to H_3O^+✓/
Die oplossing sal suur wees as gevolg van H_3O^+ (3)
[23]

TOTAL/*TOTAAL*: 150