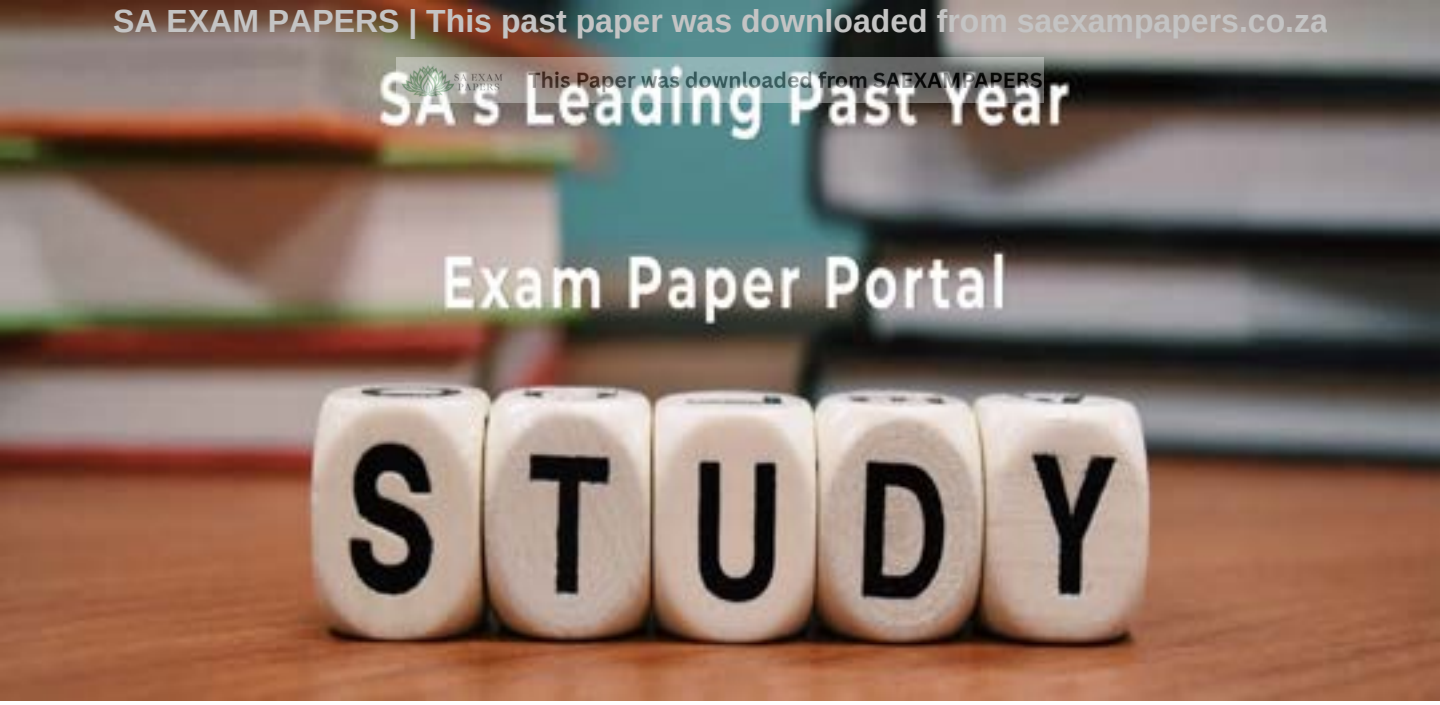


GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION
JUNIE EKSAMEN

GRADE/*GRAAD* 12

2025

MARKING GUIDELINES/
NASIENRIGLYNE

PHYSICAL SCIENCES/
FISIESE WETENSKAPPE

(PAPER/*VRAESTEL* 2)

14 pages/*bladsye*

QUESTION/*VRAAG* 1

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

[20]

QUESTION/*VRAAG* 2

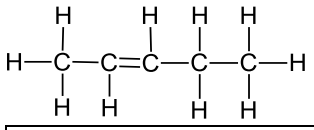
2.1 Secondary (alcohol) ✓
The carbon bonded to the hydroxyl group/functional group is bonded to two other carbon atoms. ✓✓ (2 or 0)

Sekondêre (alkohol)
Die koolstof wat aan die hidroksielgroep (funksionele groep) verbind is, is aan twee ander koolstofatome verbind. (2 of 0) (3)

2.2

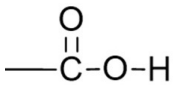
2.2.1 G ✓ (1)
2.2.2 A ✓ (1)
2.2.3 B ✓ (1)

2.3.1



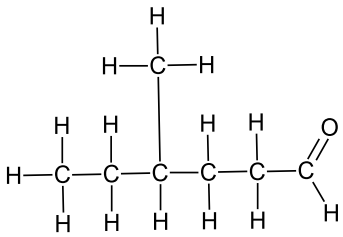
Marking criteria/*Nasienkriteria*:
- Functional group between C2 and C3/*Funksionele groep tussen C2 en C3* ✓
- Whole structure correct/*Hele struktuur korrek* ✓ (2)

2.3.2



✓✓ (2 or 0)
Carbon must have 4 bonds/*koolstof moet vier bindings hê* (2)

2.3.3



(2)

Marking criteria/*Nasienkriteria*:
- Functional group/*Funksionele groep* ✓
- Whole structure correct/*Hele struktuur korrek* ✓ (2)

2.4
2.4.1 pent-2-ene/*pent-2-een* *Accept 2-pentene*

Marking criteria/*Nasienkriteria*:
- Correct stem/*Korrekte stam* ✓
- IUPAC name completely correct/IUPAC-*naam heeltemal korrek* ✓

If pentene only 1/2/*indien penteen slegs 1/2* (2)

2.4.2 4-methylhexan-3-one/*4-metielheksan-3-oon*

Marking criteria/*Nasienkriteria*:
- Correct stem (hex)/*Korrekte stam (heks)* ✓
- All substituents correctly identified/*Alle substituente is korrek* ✓
- IUPAC name completely correct/IUPAC-*naam heeltemal korrek* ✓

(3)

2.5.1 Positional isomers. ✓

Posisionele isomere. (1)

2.5.2 Same molecular formula, ✓but different positions of the side chain, substituants or functional group on the parent chain ✓

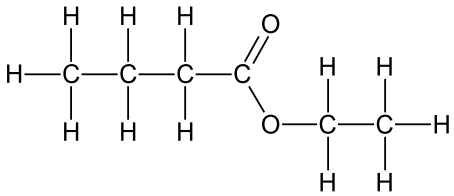
Dieselfde molekulêre formule, maar verskillende posisies van die syketting, substituente of funksionele groep op die stamketting (2)

2.6

2.6.1 Ester/*Ester* ✓ (1)

2.6.2 (Concentrated/*Gekonsentreerde)* sulphuric acid/*swawelsuur* ✓
If the formula is given then zero
Indien die formule gegee word, dan nul (1)

2.6.3



Marking criteria/*Nasien kriteria*:
- Functional group/*Funksionele groep* ✓
- Whole structure correct/*Hele struktuur korrek* ✓✓

(3)
[25]

QUESTION/*VRAAG* 3

3.1 The pressure exerted by a vapour at equilibrium with its liquid in a closed system. ✓✓

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

3.2 Alkane/*Alkaan* ✓ (1)

3.3

- Compound B has a longer chain/larger surface area / bigger molar mass than compound A. ✓
- Both have the same London forces but the intermolecular forces in B are stronger. ✓
- More energy is needed to overcome the intermolecular forces in compound B. ✓

OR/*OF*

- Compound A has a shorter chain/smaller surface area / smaller molar mass than compound B. ✓
- Both have the same London forces but the intermolecular forces in A are weaker. ✓
- Less energy is needed to overcome the intermolecular forces in compound A. ✓

- *Verbinding B het 'n langer ketting/groter oppervlakte/groter molêre massa as verbinding A.*
- *Albei het dieselfde Londonkragte maar die intermolekulêre kragte in B is sterker.*
- *Meer energie is nodig om die intermolekulêre kragte in verbinding B te oorkom.*

OR/OF

- *Verbinding A het 'n korter ketting/kleiner oppervlakte/kleiner molêre massa as verbinding A.*
- *Albei het dieselfde Londonkragte maar die intermolekulêre kragte in A is swakker.*
- *Minder energie is nodig om die intermolekulêre kragte in verbinding A te oorkom.* (3)

3.4

3.4.1 A chemical formula that indicates the element and numbers of each of the atoms in a molecule. ✓✓ (2 or 0)

'n Chemiese formule wat die element en getalle van elk van die atome in 'n molekule aandui. (2 of 0) (2)

3.4.2 E or propanoic acid/*E of propanoësuur* ✓ (1)

3.4.3

- Compound E has hydrogen bonds ✓
- Compound C has dipole-dipole forces ✓
- Stronger intermolecular forces in compound E than in C ✓
- More energy required to overcome the intermolecular forces in E ✓

- *Verbinding E het waterstofbindings*
- *Verbinding C het dipool-dipool kragte*
- *Sterker intermolekulêre kragte in verbinding E as in C*
- *Meer energie word benodig om die intermolekulêre kragte in E te oorkom* (4)

3.5 **Marking criteria/*Nasienriglyn*:**

- Calculate the % of oxygen in the alcohol. ✓
- Substitute 61; 11,86 and 27,14 in the formula $n = \frac{m}{M}$ ✓
- Divide by the smallest mols 1,696 ✓
- Correct empirical formula ✓

- *Bereken die % suurstof in die alkohol.*
- *Vervang 61; 11,86 en 27,14 in die formule* $n = \frac{m}{M}$
- *Deel deur die kleinste mol hoeveelheid 1,696*
- *Korrekte empiriese formule*

Element	% m = 100g	M	n = $\frac{m}{M}$	Ratio
C	61	12	$\frac{61}{12}$ = 5,08	$\frac{5,08}{1,696}$ ✓ = 2,99
H	11,86	1	$\frac{11,86}{1}$ = 11,86	$\frac{11,86}{1,696}$ = 6,99
O	27,14 ✓	16	$\frac{27,14}{16}$ = 1,696 ✓	$\frac{1,696}{1,696}$ = 1

Correct empirical formula/*Korrekte empiriese formule* : C_3H_7O ✓ (4)

3.6 $\underset{\checkmark}{C_3H_8}$ + $\underset{\checkmark}{5O_2 \rightarrow 3\,CO_2 + 4\,H_2O}$ ✓balancing/*balansering* (3)

[20]

QUESTION/*VRAAG* 4

4.1 Unsaturated, ✓ there are one or more multiple bonds between two carbon atoms in the hydrocarbon chain. ✓✓

Onversadig, daar is een of meer meervoudige bindings tussen C-atome in die koolwaterstofketting (3)

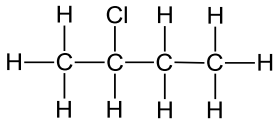
4.2

4.2.1 Addition/Hydrogenation ✓ *Addisie/Hidrogenering/Hidrogenasie* (1)

4.2.2 Substitution/ halogenation ✓ *Substitusie/halogenering* (1)

4.2.3 Elimination/dehydrohalogenation ✓ *Eliminasie/dehidrohalogenering* (1)

4.3



Marking criteria/nasienriglyne

✓ Chlorine on carbon 2/*Chloor op koolstof 2*
✓ Whole structure/*Hele struktuur* (2)

4.4

4.4.1 Hydration ✓ *Hidratering/Hidrasie* (1)

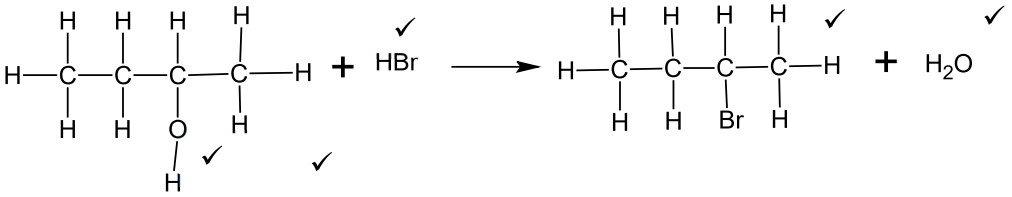
4.4.2 Excess water/H_2O ✓
Small amount of strong acid as catalyst ✓ / sulfuric acid (H_2SO_4) or phosphoric acid (H_3PO_4).

Oormaat water/H_2O
Klein hoeveelheid van 'n sterk suur as katalis / swawelsuur (H_2SO_4) of fosforsuur (H_3PO_4). (2)

4.4.3 Butan-2-ol ✓✓ accept: 2-butanol
Butan-2-ol aanvaar: 2-butanol (2)

4.5 2-methylpropane or methylpropane ✓✓*2-metielpropaan of metielpropaan* (2)

4.6



Marking criteria/*Nasienkriteria*:

- Correct structural formula of butan-2-ol ✓ the OH is on the correct carbon✓and HBr ✓
- Correct structural formula of 2-bromobutane and H_2O ✓✓
- *Korrekte struktuurformule vir butan-2-ol die OH is op die regte koolstof en HBr*
- *Korrekte struktuurformule vir 2-bromobutaan en H_2O*

If condensed structural formulae used max 2/5
Indien gekondenseerde struktuurformules gebruik maks 2/5 (5)
[20]

QUESTION/*VRAAG* 5

5.1 Reaction rate is the change in concentration of reactants or products per unit time ✓ ✓ (2 or 0)

Verandering in konsentrasie van reaktante of produkte per eenheid tyd. (2 of 0) (2)

5.2
- Number of particles per unit volume decrease ✓
- Fewer particles with enough energy available for collision ✓
- Fewer effective collisions per unit time,✓/lower frequency of effective collisions
- Reaction rate decreases✓/Lower reaction rate/Reaction slows down

- *Hoeveelheid deeltjies per eenheid volume verlaag.*
- *Minder deeltjies het genoeg energie beskikbaar vir botsings*
- *Minder effektiewe botsings per eenheid tyd/laer frekwensie van effektiewe botsings*

Reaksietempo verlaag/Laer reaksietempo/Reaksie word stadiger (4)

5.3 Rate/T*empo* $= \frac{\Delta V(CO_2)}{\Delta t}$

$= \frac{0{,}3 \checkmark - 0}{20 \checkmark - 0}$

$= 0{,}015$ ✓ $(dm^3 \cdot s^{-1})$ (3)

5.4

Marking criteria/*Nasienkriteria*:

(a) Substitute/ *Vervang* 24 in n = $\frac{V}{V_m}$ correctly with 0,5/*korrek met 0,5*✓

(b) USE/*GEBRUIK* mole ratio/*mol verhouding* 1:1
$MgCO_3 : CO_2$ ✓

(c) Molar mass of $MgCO_3$ (84) in the correct formula ✓
Molêre massa van $MgCO_3$ (84) in die korrekte formule

(d) Final answer range 1,68 g – 1,75 g ✓
Finale antwoordreeks 1,68 g – 1,75 g

$V(CO_2) = 500\ cm^3 / 1000 = 0,5\ dm^3$

$V_m = 24\ dm^3$

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

$= \frac{0,5}{24}$ ✓(a)

$= 0,02$ mol

$MgCO_3 : CO_2$

1 : 1

0,02: 0,02 ✓ **(b)**

$n(MgCO_3) = \frac{m}{M}$

$0,02 = \frac{m}{84}$ ✓ (c)

m = 1,75 g ✓ **(d)** (4)

5.5

5.5.1 Graph/*Grafiek* B ✓ (1)

5.5.2
- A peak/maximum at a higher kinetic energy/peak shifted to the right. ✓
- More molecules have Ek > Ea ✓

- *'n Piek/maksimum by 'n hoër kinetiese energie/piek skuif na regs.*
- *Meer molekule het Ek > Ea* (2)

5.5.3 LEFT/*LINKS* ✓ (1)

5.6

5.6.1 Exothermic/*Eksotermies*✓ (1)

5.6.2 B ✓ or D (1)

5.6.3 10 (kJ) ✓ (1)

[20]

QUESTION/*VRAAG* 6

6.1

Marking criteria/*Nasienkriteria*

If any one of the underlined key phrases in the correct context is omitted, deduct 1 mark.

Indien enige een van die onderstreepte sleutelfrases in die korrekte konteks weggelaat word, trek 1 punt af.

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. ✓✓ (do not accept isolated system)

Wanneer die ewewig in 'n geslote sisteem versteur word,stel die sisteem 'n nuwe ewewig in deur die reaksie wat die versteuring teenwerk te bevoordeel. (moet nie geïsolleerde sisteem aanvaar nie) (2)

6.2 **Marking criteria/*Nasienkriteria*:**

(a) USING ratio/*GEBRUIK verhouding*
$n(CS_2)$: $n(C\ell_2)$: $n(CC\ell_4)$: $n(S_2C\ell_2)$ = 1:3:1:1. ✓

(b) $n_{equilibrium/ewewig} = n_{initial/aanvanklik} -/+ n_{change/verandering}$ ✓

(c) Divide $n_{equilibrium}$ by the volume 2 dm^3 ✓
Deel n_{ewewig} deur die volume 2 dm^3

(d) Correct K_c expression (formulae in square brackets). ✓
Korrekte K_c uitdrukking (formule in blokhakkies).

(e) Substitute K_c value 0,36 ✓
Vervang die K_c waarde 0,36

(f) Substitution of equilibrium concentrations into K_c expression.✓
Vervang ewewigkonsentrasies in K_c uitdrukking

(g) Solve for x /Los op vir x ✓

(h) Final answer/*Finale antwoord*: 1,21 mol (1,20459 mol) ✓

OPTION 1/*OPSIE 1*	$CS_2(g)$	$C\ell_2(g)$	$CC\ell_4(g)$	$S_2C\ell_2(g)$
Initial amount moles/*Aanvanklike mol hoeveelheid*	x	5	0	0
Change in amount (moles)/*Verandering in hoeveelheid(mol)*	-0,8	-2,4	+0,8	+0,8 ✓**(a)**
Equilibrium amount (moles)/ /*Ewewigshoeveelheid*	x – 0,8	2,6	0,8	0,8 ✓**(b)**
Equilibrium concentration/ *Ewewigskonsentrasie* (mol·dm^{-3})	$\frac{x - 0,8}{2}$	$\frac{2,6}{2}$ = 1,3	$\frac{0,8}{2}$ = 0,4	$\frac{0,8}{2}$ = 0,4 ✓**(c)**
$K_c = \frac{[CC\ell_4][S_2C\ell_2]}{[CS_2][C\ell_2]3}$ ✓**(d)** 0,36 ✓**(e)**=$\frac{(0,4)(0,4)}{[CS_2](1,3)^3}$ ✓**(f)** $[CS_2]$ = 0,202… $\frac{x - 0,8}{2}$ ✓**(g)**= 0,202… x = 1,20 mol ✓**(h)** (1,20459 mol)	No K_c expression, correct substitution Max 7/8 Wrong K_c expression Max 4/8 *Geen K_c uitdrukking, korrekte vervanging* *Maks 7/8* *Verkeerde K_c uitdrukking Maks 4/8*			

OPTION 2/*OPSIE 2*

	$CS_2(g)$	$C\ell_2(g)$	$CC\ell_4(g)$	$S_2C\ell_2(g)$
Initial concentration/*Aanvanklike konsentrasie*	$\frac{x}{2}$	2,5 ✓**(c)**	0	0
Change in concentration /*Verandering in konsentrasie*	-0,4	-1,2	+0,4	+0,4 ✓**(a)**
Equilibrium concentration/ *Ewewigskonsentrasie* (mol·dm^{-3})	$\frac{x - 0,8}{2}$	1,3	0,4	0,4 ✓**(b)**
$K_c = \frac{[CC\ell_4][S_2C\ell_2]}{[CS_2][C\ell_2]3}$ ✓**(d)** 0,36 ✓**(e)**=$\frac{(0,4)(0,4)}{[CS_2](1,3)^3}$ ✓**(f)** $[CS_2]$ = 0,202… $\frac{x - 0,8}{2}$ ✓**(g)**= 0,202… x = 1,20 mol ✓**(h)** (1,20459 mol)	No K_c expression, correct substitution Max 7/8 Wrong K_c expression Max 4/8 *Geen K_c uitdrukking, korrekte vervanging* *Maks 7/8* *Verkeerde K_c uitdrukking Maks 4/8*			

(8)

6.3.1 Increase ✓
Removing the carbon tetrachloride will decrease the concentration of the product the system will try to increase the products by favouring the forward reaction ✓concentration of reactants will decrease and products will increase.

Vermeeder
Die verwydering van die koolstoftetrachloried sal die konsentrasie van die produk verlaag, die stelsel sal probeer om die produkte te verhoog deur die voorwaartse reaksie te bevoordeel, konsentrasie van reaktante sal afneem en produkte sal toeneem (2)

6.3.2 Decrease ✓
Volume is increased then pressure is decreased. The system will counteract the change by favouring the reaction that produces the greater amount of moles. Therefore, the reverse reaction✓ is favoured the concentration of reactants will increase and products will decrease.

Verminder
Volume word verhoog en druk verminder. Die sisteem sal die verandering teëwerk deur die reaksie te bevoordeel wat die meeste mol produseer. Daarom word die terugwaartse reaksie bevoordeel, die konsentrasie van reaktante sal toeneem en produkte sal afneem. (2)

6.4.1 Decreased/*Verlaag* ✓ (1)

6.4.2
- Temperature INCREASES ✓
- Increase in temperature favours endothermic reaction ✓
- Reverse reaction is favoured ✓
- Reverse reaction is endothermic ✓

- *Temperatuur VERHOOG*
- *Toename in temperatuur bevoordeel endotermiese reaksie*
- *Terugwaartse reaksie word bevoordeel*
- *Terugwaartse reaksie is endotermies* (4)

6.4.3 22 (minutes/*minute*) ✓ (1)
[20]

QUESTION/*VRAAG* 7

7.1 Weak acids ionise incompletely in water ✓ to form a low concentration of H_3O^+ ions.✓

Swak sure ioniseer onvolledig in water om 'n lae konsentrasie H_3O^+-ione te vorm. (2)

7.2 $H_2C_2O_4$; $HC_2O_4^-$ ✓✓ OR/*OF* H_3O^+ ; $HC_2O_4^-$ (2)

7.3 Oxalic acid can donate two protons (H^+) ✓during its ionisation in an aqueous solutions/It ionises to form 2 protons.

Oksaalsuur kan twee protone (H^+) skenk tydens die ionisasie daarvan in 'n waterige oplossings/Dit ioniseer om 2 protone te vorm. (1)

7.4 A substance that can act as either an acid or a base.✓
Accept: a substance that can donate or accept a proton

'n Stof wat as beide 'n suur of 'n basis kan reageer.
Aanvaar: 'n stof wat 'n proton kan skenk of ontvang (1)

7.5.1

OPTION 1/*OPSIE* 1	**OPTION 2/*OPSIE* 2**	
$c = \frac{m}{MV}$ ✓	$n = \frac{m}{M}$	$c = \frac{n}{V}$ ✓
$= \frac{2,25}{90(0,25)}$ ✓	$= \frac{2,25}{90}$	(for both formulae/*vir beide formules*)
= 0,1 mol.dm^{-3} ✓	= 0,025 mol	$= \frac{0,025}{0,25}$ ✓
		= 0,1 mol.dm^{-3} ✓

(3)

7.5.2 **Positive marking from 7.5.1/*positiewe nasien vanaf 7.5.1***
Marking criteria/*Nasienkriteria*:

(a) Any formula/*Enige formule* $c = \frac{n}{V}$ OR $\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$
(b) Substitution/*Vervanging*
(c) USE mole ratio/*GEBRUIK mol verhouding* $H_2C_2O_4$: NaOH as 1 : 2
(d) Final answer/*Finale antwoord*: 0,18 mol·dm^{-3}
(accept/*aanvaar* 0,175 mol.dm^{-3})

OPTION/*OPSIE* 1	**OPTION/*OPSIE* 2**
$c(H_2C_2O_4) = \frac{n}{V}$ ✓**(a)**	$\frac{c_a V_a}{c_b V_b} = \frac{n_a}{n_b}$ ✓ **(a)**
n = (0,1)(0,025) ✓**(b)**	$\frac{(0,1)(0,025)}{c_b(0,0286)}$ ✓ **(b)** $= \frac{1}{2}$ ✓**(c)**
= 0,025 mol	c_b = 0,18 mol·dm^{-3} ✓**(d)**
$c(NaOH) = \frac{n}{V}$	
$= \frac{2(0,0025)}{0,0286}$ ✓**(c)**	
= 0,18 mol·dm^{-3} ✓**(d)**	

(4)

7.5.3 Phenolphthalein is a suitable indicator for the titration of oxalic acid and sodium hydroxide because the reaction involves a strong base (NaOH) and a weak acid ✓($H_2C_2O_4$). The endpoint of the titration occurs when the pH is greater than 7 ✓
OR
Because the salt of the titration will undergo hydrolysis and form a basic salt solution.

Fenolftaleïen is 'n geskikte indikator vir die titrasie van oksaalsuur en natriumhidroksied omdat die reaksie tussen 'n sterk basis (NaOH) en 'n swak suur ($H_2C_2O_4$) is. Die eindpunt van die titrasie word bereik wanneer die pH groter as 7 is.
OF
Omdat die sout van die titrasie hidrolise sal ondergaan en 'n basiese soutoplossing sal vorm. (2)

7.6 **Marking criteria/*Nasienkriteria*:**

(a) Substitution/*Vervanging* ($Mg(OH)_2$) : (0,115)(0,05) ✓
(b) Substitution/*Vervanging* (HNO_3) : (0,095)(0,025) ✓
(c) USE ratio/*GEBRUIK verhouding*: $2n(HNO_3)$: = $n(Mg(OH)_2)$ ✓
(d) $n(Mg(OH)_2)_{excess/oormaat} = n_{initial/aanvanklik} - n_{reacted/gereageer}$
$= 0,00575 - 0,0011875$✓
(e) Use the ratio $2\ OH^-$: $Mg(OH)_2$
(f) Substitute/*Vervang* 0,075 dm^3 ✓
(g) Use/*gebruik* $K_w = [H_3O^+]\ [OH^-]$ ✓
(h) Substitute/*Vervang* $[OH^-] = 0,12166$ ✓
(i) Formula/*Formula* $pH = - \log [H_3O^+]$ ✓
(j) Range for final answer/*Gebied vir finale antwoord: (13,08 - 13,12)* ✓

$c(Mg(OH)_2) = \frac{n}{V}$

$n = (0,115)(0,05)$ ✓ **(a)**

$= 0,00575$ mol

$c(HNO_3) = \frac{n}{V}$

$n = (0,095)(0,025)$ ✓**(b)**

$= 0,002375$ mol

$HNO_3 : Mg(OH)_2$

2:1

$0,002375 : 0,0011875$ ✓**(c)**

$n(Mg(OH)_2)_{excess/oormaat} = n_{initial/aanvanklik} - n_{reacted/gereageer}$

$= 0,00575 - 0,0011875$

$= 0,0045625$ mol ✓**(d)**

$OH^- : Mg(OH)_2$

2:1

$0,009125 : 0,0045625$ ✓**(e)**

$c[OH^-] = \frac{n}{V}$

$= \frac{0,009125}{0,075}$ ✓(f)

$= 0,12166$ mol·dm^{-3}

$K_w = [H_3O^+][OH^-]$ ✓**(g)**

$1 \times 10^{-14} = [H_3O^+][0,12166]$ ✓**(h)**

$[H_3O^+] = 8,219 \times 10^{-14}$

$pH = - \log [H_3O^+]$ ✓ **(i)**

$= - \log (8,219 \times 10^{-14})$

$= 13,082$ ✓**(j)**

OR/*OF*

$pH + pOH = 14$

$pH = 14 - (- \log [OH^-])$

$= 14 - (- \log(0,12166))$

$= 13,085$ (10)

[25]

TOTAL/*TOTAAL:* 150