GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

PREPARATORY EXAMINATION

VOORBEREIDENDE EKSAMEN



2025

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MARKING GUIDELINES
NASIENRIGLYNE



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10842

PHYSICAL SCIENCES: CHEMISTRY
FISIESE WETENSKAPPE: CHEMIE

(PAPER/*VRAESTEL* 2)

11 pages/*bladsye*

QUESTION/*VRAAG* 1

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

[20]

QUESTION/*VRAAG 2*

2.1.1 Ketone/*Ketoon* ✓ (1)

2.1.2 Haloalkane ✓ or alkyl halide/*Haloalkane of alkielhalied* (1)

2.2 1-bromo-3-chloro-4-methylpentane/
1-bromo-3-chloro-4-metielpentaan ✓✓✓ (3)

Marking criteria/*Nasienriglyne*:
- Correct stem (pentane) ✓/*korrekte stamnaam (pentaan)*
- All substituents (chloro, bromo and methyl) were correctly identified. ✓/*alle substituente (chloro, bromo en metiel) is korrek geïdentifiseer*
- IUPAC name is completely correct including numbering, sequence, hyphens and commas. ✓/*IUPAC naam is heeltemal korrek insluitend nommering, volgorde, koppeltekens en kommas*

2.3 A ✓ (1)

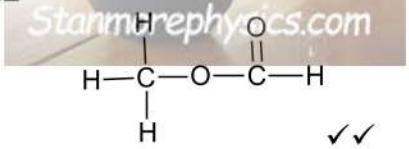
2.4.1



✓✓

Marking criteria/*Nasienriglyne*:
- Functional group **-COH** on the first carbon ✓/*Funksionele groep* **–COH** *op die eerste koolstof*
- Correct whole structure ✓/*Korrekte volledige struktuur* (2)

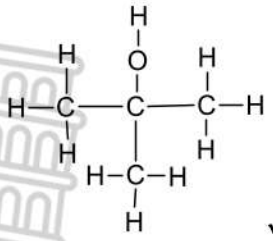
2.4.2



✓✓

Marking criteria/*Nasienriglyne*:
- Functional group **-COOC-** ✓/*Funksionele groep* ***–COOC-***
- Correct whole structure ✓/*Korrekte volledige struktuur* (2)

2.4.3



✓✓

Marking criteria/*Nasienriglyne*:
- Correct stem – 3 carbons ✓/*Korrekte stam- 3 koolstowwe*
- Functional group **-OH** <u>and</u> a methyl on the second carbon ✓ the O must be bonded on the C/*Funksionele groep* **-OH** <u>*en*</u> *metielgroep op tweede koolstof, die O moet op die C gebind wees*

(2)

2.5 Unsaturated indicates a mulitple bond between two C atoms. ✓
This compound has an oxygen atom, hydrocarbons do not have an Oxygen. ✓

Onversadig dui aan om meervoudige bindings tussen C atome.
Hierdie verbinding het 'n suurstofatoom, koolwaterstowwe moet nie 'n suurstof hê nie. (2)

2.6.1 E ✓ (1)

2.6.2 A ✓ (1)

2.7 C_5H_{12} ✓+ <u>$8O_2 \rightarrow 5CO_2 + 6H_2O$</u> ✓ ✓ balancing/*balansering* (3)

2.8 Empirical formula/*Empiriese formule* = CH_2O
Molar mass/*Molêre massa* = 150 $g.mol^{-1}$
$M(CH_2O)$ = 30 $g.mol^{-1}$
Molecular formula/*Molekulêre formule* = ?

$\frac{150}{30}$ ✓ $= 5$

Molecular formula/*Molekulêre formule* = 5 x CH_2O
= $C_5H_{10}O_5$ ✓ (2)

[21]

QUESTION/*VRAAG 3*

3.1 The temperature at which the vapour pressure of a substance equals atmospheric pressure. ✓✓/ (2 or 0)
Die temperatuur waarby die dampdruk van die stof gelyk is aan atmosferiese druk. (2)

3.2 Different homologous series ✓ OR organic compounds with different functional groups
Verskillende homoloë reekse OF organiese verbindings met verskillende funksionele groepe (1)

3.3
- Both B and C have dipole-dipole forces. ✓
- A has London forces. ✓
- The intermolecular forces in C are stronger than those in B and the weakest in A. ✓
- Therefore, C will require more energy to overcome the forces between the molecules than in B or A. ✓

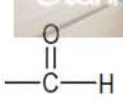
- *Beide B en C het dipool-dipoolkragte.*
- *A het London kragte.*
- *Die intermolekulêre kragte in C is sterker as dié in B en die swakste in A.*
- *Daarom sal C meer energie benodig om die kragte tussen die molekules te oorkom as in B of A.* (4)

3.4 Marking criteria/*Nasienkriteria*
Do not accept if the reason is given as inversely proportional.
Moet nie aanvaar indien die rede gegee word as omgekeerd eweredig nie.

D ✓
The highest boiling point (will have the lowest vapour pressure). ✓
OR
D has the strongest intermolecular forces and will need the most energy to weaken the intermolecular forces.
OR
D has the highest number of particles present in the vapour phase.

Die hoogste kookpunt (sal die laagste dampdruk hê).
OF
D het die sterkste intermolekulêre kragte en sal dus die meeste energie benodig om die intermolekulêre kragte te verswak.
OF
D het die hoogste getal deeltjies in die dampfase. (2)

3.5.1 Liquid/*Vloeistof* ✓ (1)

3.5.2

✓ (1)

3.5.3 2-Butanone OR butan-2-one OR butanone ✓/ *2-butanoon OF butan-2-oon OF butanoon* NO marks for but-2-one *GEEN punte vir but-2-oon* (1)
[12]

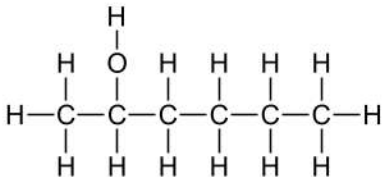
QUESTION/*VRAAG* 4

4.1.1 Esterification OR Condensation/*Verestering/Esterifikasie/Kondensasie* ✓ (1)

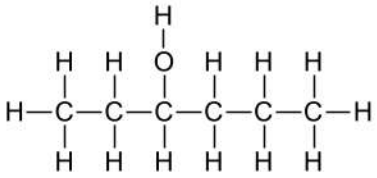
4.1.2 Addition/*Addisie*✓
Accept: bromination/halogenation
Aanvaar: *brominering/halogenering* (1)

4.1.3 Elimination/*Eliminasie* ✓
Accept: dehydration
Aanvaar: *dehidrasie* (1)

4.2



OR/*OF*

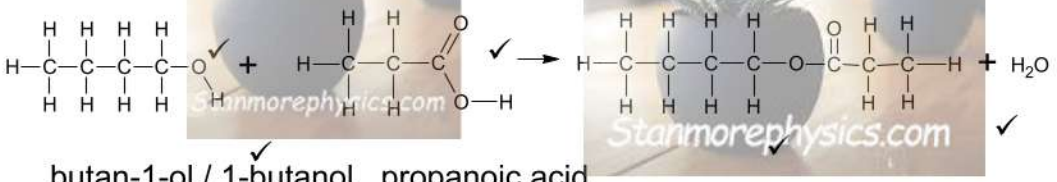


✓✓

Marking criteria/*Nasienriglyne:*
- Correct stem – six carbons ✓/*Korrekte stam – ses koolstowwe*
- Functional group **-OH** on the 2nd or 3rd carbon/*funksionele groep* **-OH** *op die 2de of 3de koolstof* ✓

(2)

4.3



✓ ✓ ✓ ✓

butan-1-ol / 1-butanol propanoic acid
butan-1-ol / 1-butanol propanoësuur

do not accept butanol/*moenie butanol aanvaar nie*

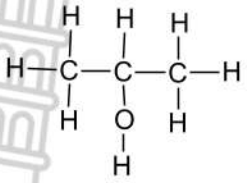
Marking criteria/*Nasienriglyne*:
- Whole structure correct for butan-1-ol ✓ /*Korrekte volledige struktuur vir butan-1-ol*
- Correct name reactant 1/*Korrekte naam reaktant 1*
- Whole structure correct for propanoic acid ✓/*Korrekte volledige struktuur vir propanoësuur*
- Correct name reactant 2/*Korrekte naam reaktant 2*
- Whole structure correct for ester ✓/*Korrekte volledige struktuur vir ester*
- Correct formula for water/*Korrekte formule vir water*

(6)

4.4 To act as a catalyst/*Dit dien as 'n katalisator* ✓ (1)

4.5 Hydroxyl (group) /*Hidroksiel(groep)* ✓ (1)

4.6.1 Water and a strong acid (suphuric acid/phosphoric acid) ✓
Water en 'n sterk suur (swawelsuur/fosforsuur) (1)

4.6.2 

Marking criteria/*Nasienriglyne*:
- Functional group **-OH** on the 2nd carbon ✓/*Funksionele groep* **–OH** *op die 2de koolstof*
- Correct whole structure ✓/*Korrekte volledige struktuur* (2)

4.6.3 Hydration/*Hidrasie* ✓ (1)

4.6.4 By using their different boiling points. ✓/*deur gebruik te maak van die verskillende kookpunte.* (1)
[18]

QUESTION/*VRAAG* 5

5.1 The energy absorbed or released in a chemical reaction. ✓✓ *(2 or 0)*
Die energie geabsorbeer of vrygestel in 'n chemiese reaksie. (2)

5.2.1 <u>The concentration</u> (of the sodium thiosulfate/$Na_2S_2O_3$.) ✓/<u>*Konsentrasie*</u> *(van die natriumtiosulfaat*/$Na_2S_2O_3$) (1)

5.2.2 Average rate of reaction/*Gemiddelde tempo van reaksie*
$= \frac{0{,}080\ ✓}{35\ ✓}$
= 0,0023 ($mol{\cdot}dm^{-3}.s^{-1}$)✓ ($2{,}3x10^{-3}$) (3)

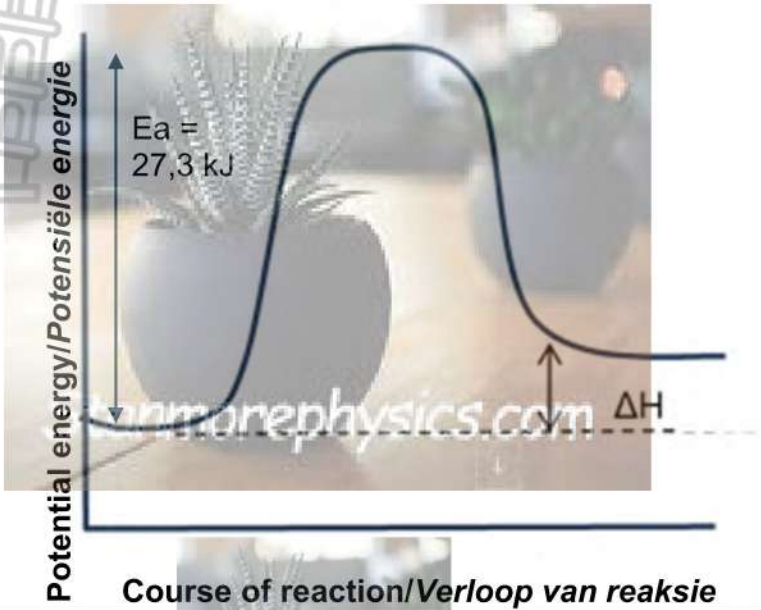
5.2.3 The sulphur/<u>sulfur</u> ✓ that forms is a solid and covers the visibility of the cross/ Precipitaite is formed/murky solution
Die <u>swawel</u> wat vorm is 'n vaste stof en bedek die sigbaarheid van die kruis/ neerslag vorm/deinserige oplossing/ondeursigtige oplossing (1)

5.2.4
- As the concentration increases, the <u>number of particles per unit volume</u> increases ✓
- <u>More effective collisions per unit time</u> ✓
- <u>The rate of reaction increase</u> ✓

- *Soos die konsentrasie toeneem, neem <u>die aantal deeltjies per volume</u>-eenheid toe*
- *<u>Meer effektiewe botsings vind per tydseenheid plaas</u>*
- *<u>Die reaksietempo neem toe</u>* (3)

5.3.1 The minimum energy needed for a reaction to take place. ✓✓ *(2 OR 0)*
Die minimum energie benodig vir 'n reaksie om plaas te vind. (2)

5.3.2



Marking criteria/*Nasienkriteria*:
- The shape is endothermic. ✓/*Die vorm is endotermies*
- Axes labelled correctly AND Ea (Activation energy) or ΔH indicated ✓if time on x-axis no marks /*Asse korrek benoem EN Ea (aktiveringsenergie) ΔH aangedui / indien tyd op x-as geen punte* (2)

[14]

QUESTION/*VRAAG* 6

6.1.1 It is a dynamic equilibrium when the rate of the forward reaction is equal to the rate of the reverse reaction. ✓✓
Dit is 'n dinamiese ewewig wanneer die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie. (2)

6.1.2 According to Le Chatelier's principle:
- An increase in temperature favours the endothermic reaction ✓
- The reverse reaction will be favoured ✓
- The colour of the solution changes to yellow ✓

Volgens Le Chatelier se beginsel:
- *'n Toename in temperatuur bevoordeel die endotermiese reaksie*
- *Die terugwaartse reaksie sal bevoordeel word*
- *Die kleur van die oplossing word geel* (3)

6.1.3 Increases ✓

- Adding concentrated HCl increases the concentration of the common ion H^+ , the system will react to decrease the concentration of the H^+ ions by favouring the forward reaction✓
- More dichromate ions form, the colour of the solution changes to orange. ✓

Verhoog

- *Die byvoeging van gekonsentreerde HCl verhoog die konsentrasie van die gemeenskaplike H^+ ioon, die sisteem sal reageer om die konsentrasie van die H^+ ione te verlaag deur die voorwaartse reaksie te bevoordeel.*
- *Meer dichromaatione vorm, die kleur van die oplossing word oranje* (3)

6.2.1 $K_c = \frac{[CO_2]}{[CO]^2}$ ✓

$K_c = \frac{(1{,}21 \times 10^{-3})}{(1{,}1 \times 10^{-2})^2}$ ✓

$K_c = 10$

Since the $K_{c\ new} = K_{c\ original}$ therefore the system is in equilibrium. ✓ Kc value remains the same

Aangesien die $K_{c\ nuwe} = K_{c\ oorspronklike}$ is die sisteem in ewewig/Kc waarde bly dieselfde (3)

6.2.2

Marking criteria

(a) Substitution of concentration into Kc expression. ✓
(b) n at equilibrium ✓
(c) Calculating the change in mole of CO ✓
(d) Using the mole ratio of $2CO:1CO_2$. ✓
(e) Calculating the new initial n of CO_2 ✓
(f) subtracting mol ✓
(g) final answer ✓

***Nasienkriteria**:*

(a) Vervanging van konsentrasie in Kc uitdrukking
(b) n by ewewig
(c) bereken die verandering in mol van CO
(d) gebruik die mol verhouding van $2CO:1CO_2$.
(e) bereken die nuwe aanvanklike n van CO_2
(f) aftrek van mol
(g) finale Antwoord

OPTION 1/*OPSIE 1*

$K_c = \frac{[CO_2]}{[CO]^2}$

$10 = \frac{(x)}{(x)^2}$ ✓ **(a)**

$x = 0{,}1$

$\therefore [CO_2] = [CO] = 0{,}1$ mol•dm^{-3}

(7)

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	2CO	CO_2
$n_{initial}/n_{aanvanklik}$	$1{,}1 \times 10^{-2}$	$1{,}445 \times 10^{-1}$ ✓ **(e)**
$\Delta n_{change}/\Delta n_{verandering}$	0,089 ✓ **(c)**	0,0445✓ (ratio) **(d)**
$n_{equilibrium}/n_{ewewig}$	0,1	0,1 ✓ **(b)**
$c_{equilibrium}/c_{ewewig}$	x	x

$n_{added/bygevoeg} = n_{new\ initial/nuwe\ aanvanklik} - n_{original\ mole\ at\ eq/oorspronklike\ mol\ by\ ew.}$

$= 1{,}445 \times 10^{-1} - 1{,}21 \times 10^{-3}$ ✓ **(f)**

$= 0{,}143$ mol ✓ **(g)**

OPTION 2/*OPSIE2*

	CO	CO_2
Ratio	2	1
n_i	$1{,}1 \times 10^{-2}$	$1{,}21 \times 10^{-3} + x$
Δn	$1{,}1 \times 10^{-2} + 2y$	$1{,}21 \times 10^{-3} + x - y$
n_f	0,1	0,1
c=n/V	0,1	0,1

$1{,}1 \times 10^{-2} + 2y = 0{,}1$

$2y = 0{,}089$

$y = 0{,}0445$ mol

$1{,}21 \times 10^{-3} + x - y = 0{,}1$

$1{,}21 \times 10^{-3} + x - 0{,}0445 = 0{,}1$

$x = 0{,}14329$ mol added

[18]

QUESTION/*VRAAG* 7

7.1.1 A concentrated sodium hydroxide solution contains a large amount of base particles as compared to the water particles ✓
'n Gekonsentreerde natriumhidroksiedoplossing bevat 'n groot hoeveelheid basisdeeltjies in verhouding met die volume waterdeeltjies. (1)

7.1.2 Decreases. ✓
Since hydroxide ions increase, ✓ the hydronium decreases because K_w is constant ✓
Neem af.
Omdat die hidroksiedione toeneem moet die hidronium ione verminder aangesien K_w konstant is (3)

7.1.3

OPTION 1/*OPSIE 1*	OPTION 2/*OPSIE 2*
$pH = -\log[H_3O^+]$ ✓or $[H_3O^+] = 10^{-pH}$ $12✓ = -\log[H_3O^+]$ $[H_3O^+] = 1 \times 10^{-12}$ $\therefore K_w = [H_3O^+][OH^-]$ $= 1 \times 10^{-14}$ ✓ $[OH^-] = \frac{1 \times 10^{-14}}{1 \times 10^{-12}}$ $[OH^-] = 1 \times 10^{-2}$ mol. dm^{-3}✓	pH + pOH = 14 12 + pOH = 14 ✓ pOH = 2 pOH = -log[OH$^-$] ✓ 2✓ = -log[OH$^-$] $[OH^-] = 1 \times 10^{-2}$ mol. dm^{-3}✓

(4)

7.2.1 $\text{Average}/Gemiddeld = \frac{20,05 + 20,15 + 20,10}{3}$
= 20,10 cm^3 ✓ (0,0201 dm^3) (1)

7.2.2 **POSITIVE MARKING FROM 7.2.1/*POSITIEWE NASIEN VANAF 7.2.1***

OPTION 1/*OPSIE 1*
n_{HCl} = cV
= 0,0958 (0,0201)✓
= 1,92558 x10^{-3} mol

since/*aangesien* $n_{NaOH} : n_{HCl}$
= 1 : 1✓

$\therefore$ n $_{NaOH}$ = 1,92558 x 10^{-3}

$\therefore$ $c_{NaOH} = \frac{n}{V}$ ✓
$= \frac{1,92558 \times 10^{-3}}{0,02}$ ✓
= 0,0963 mol.dm^{-3}

OPTION 2/*OPSIE 2*
$\frac{c_1V_1}{c_2V_2} = \frac{n_1}{n_2}$
$\frac{(0,0958)(20,1)}{c_2(20)} = \frac{1}{1}$
c_2 = 0,0963 mol·dm^{-3}

Marking criteria:
(a) Calculating mol of HCl
(b) Use ratio
(c) Formula mark for $c_{NaOH} = \frac{n}{V}$
(d) Substitution of correct values (4)

Nasienkriteria:
(a) Bereken mol HCl
(b) Gebruiksverhouding
(c) Formulepunt $c_{NaOH} = \frac{n}{V}$
(d) Vervanging van korrekte waardes

7.2.3 $n_{NaOH\ used/gebruik} = cV$
$= 0,0963\ (0,02445)$ ✓
$= 2,354 \times 10^{-3}$ mol

Ratio $n_{NaOH} : n_{H3PO4}$
3 : 1✓

$\therefore n_{H3PO4\ used/gebruik} = \frac{2,354 \times 10^{-3}}{3}$
$= 7,848 \times 10^{-4}$ mol
in 10 cm^3 of solution/*oplossing*✓

$\therefore n_{H3PO4}$ in 250 cm^3 of solution/*oplossing*
$= \frac{250}{10}\ (7,848 \times 10^{-4})$✓
$= 0,01962$ mol

$\therefore$ m = nM
$= 0,01962(98)$ ✓
$= 1,92276$ g

$\therefore$ % purity/*suiwerheid* $= \frac{1,92276}{10} \times 100\ \%$ ✓
$= 19,23\ \%$✓

(Range/*Reeks* 19,11 – 19,30) (7)
[20]

QUESTION/*VRAAG* 8

8.1 (i) Mg/magnesium rod/*magnesiumstaaf* ✓
(ii) Cu/copper rod/*koperstaaf* ✓
(iii) $MgSO_4$/magnesium sulphate solution/*magnesiumsulfaatoplossing* ✓
(iv) $CuSO_4$/copper(II)sulphate solution/*koper(II)sulfaatoplossing* ✓ (4)

8.2 $Cu^{2+} + 2e^- \rightarrow Cu$ ✓✓
-1 mark if double arrow used/*-1 indien dubbelpyle gebruik is* (2)

8.3 $E°_{cell/sel} = E°_{cathode/katode} - E°_{anode/anode}$ ✓ (any one of the three as on data sheet)
$= +0,34$✓ $- (-2,36)$ ✓
$= 2,7$ V ✓ (4)

8.4 The salt bridge completes the circuit ✓ **OR**
It maintains the electrical neutrality of the two solutions by providing a pathway for the ions to be exchanged. OR separates the two half cells
Die soutbrug voltooi die stroombaan ***OF***
Dit handhaaf die elektriese neutraliteit van die twee oplossings deur 'n pad te verskaf vir die ione om uitgeruil te word. OF skei die twee halfselle (1)

8.5.1 DECREASE/*VERLAAG* ✓✓ (2)

8.5.2 REMAINS THE SAME/*BLY DIESELFDE* ✓ (1)
[14]

QUESTION/*VRAAG 9*

9.1 A substance whose aqueous solution contains ions OR a substance that dissolves in water to form a solution that conducts electricity.✓✓

'n Stof waarvan die oplossing in water ione bevat OF 'n Stof wat in water oplos om 'n oplossing te vorm wat elektrisiteit gelei. (2)

9.2 Copper(II)sulfate or copper(II)chloride solution or any other copper(II) solution /*koper(II)sulfaat of koper(II)chloride of enige ander koper(II) oplossing* ✓ (1)

9.3 $Cu \rightarrow Cu^{2+} + 2e^-$ ✓✓
-1 mark if double arrow used/*-1 indien dubbelpyle gebruik is* (2)

9.4 Silver/Ag is a weaker reducing agent ✓ than copper, ✓ and silver will not be oxidised at the anode. ✓
OR
Copper is a stronger reducing agent than silver and silver will not be oxidised at the anode.

Silwer/Ag is 'n swakker reduseermiddel as koper, en daarom sal silwer sal nie by die anode geoksideer word nie.
OF
Koper is 'n sterker reduseermiddel as silwer en daarom sal silwer nie by die anode geoksideer word nie. (3)

9.5

If Cu^{2+} is used/*As Cu^{2+} gebruik word*

$n_{Cu} = \frac{m}{M}$ ✓
$= \frac{1,6}{63,5}$ ✓
$= 0,02519$ mol

Since 1 Cu atom gives off $2e^-$/*Aangesien 1 Cu-atoom $2e^-$ afgee*

$\therefore n_{e^-} = 0,02519\ (2)$ ✓
$= 0,05039$ mol

$n = \frac{N}{N_A}$
$N = (0,05039)(6,02 \times 10^{23})$✓
$= 3,034 \times 10^{22}$ electrons/*elektrone* ✓ (5)

Marking criteria:
- ✓ formula for calculating n
- ✓ substitution of molar mass 63,5
- ✓ mole ratio used
- ✓ substitution of N_A in formula
- ✓ final answer

Nasienkriteria:
- ✓ formule vir die berekenin van n
- ✓ vervanging van molêre massa van 63,5
- ✓ mol verhouding gebruik
- ✓ vervanging van N_A in formule
- ✓ finale antwoord

[13]

TOTAL/TOTAAL: 150