education

MPUMALANGA PROVINCE

REPUBLIC OF SOUTH AFRICA

NATIONAL

SENIOR CERTIFICATE

PHYSICAL SCIENCES
FISIESE WETENSKAPPE
GRADE 12/*GRAAD 12*

PHYSICAL SCIENCES (P1 & P2)
FISIESE WETENSKAPPE (V1 & V2)

CONTROL TEST (MARKING GUIDELINES)

KONTROLETOETS (NASIENRIGLYNE)

MARCH/*MAART* 2026

Approved
20/03/2026

MARKS: 100

This marking guidelines consists of 14 pages

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QUESTION 1/ *VRAAG 1*

1.1 A ✓✓ (2)

1.2 B ✓✓ (2)

1.3 C ✓✓ (2)

1.4 A ✓✓ (2)

1.5 B ✓✓ (2)

[10]

QUESTION 2/ *VRAAG 2*

2.1

Marking criteria/Nasienkriteria

If any one of the underlined key phrases in the correct context is omitted, deduct 1 *mark/Indien enige van die onderstreepte frases in die korrekte konteks uitgelaat is, trek 1 punt af.*

Each body in the universe attracts every other body with a force that is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centres ✓✓

Elke liggaam in die heelal trek elke ander liggaam aan met 'n krag direk eweredig aan die produk van hul massas en omgekeerd eweredig aan die kwadraat van die afstand tussen hul middelpunte. (2)

2.2 $F = G\frac{m_1 m_2}{r^2}$ ✓

$$F = (6{,}67\times10^{-11})\frac{(2\times10^{4})(4\times5{,}98\times10^{24})}{((\frac{1}{3}\times6{,}38\times10^{6}+4\ 000\times10^{3}))^{2}}$$ ✓✓

$F = 850\ 097{,}0327$ N ✓ (4)

2.3 EQUAL TO ✓
GELYK AAN (1)

[07]

QUESTION 3 / *VRAAG 3*

3.1

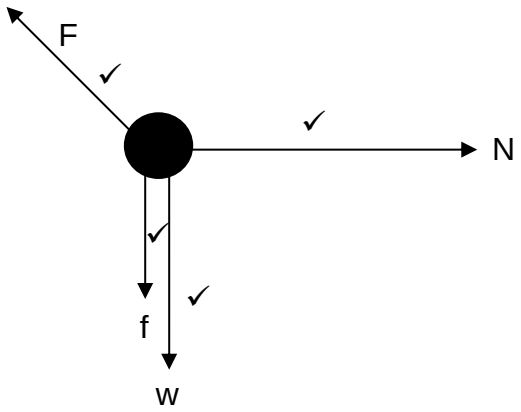
Marking criteria/Nasienkriteria
If any one of the underlined key phrases in the correct context is omitted, deduct 1 *mark/Indien enige van die onderstreepte frases in die korrekte konteks uitgelaat is, trek 1 punt af.*

Force that opposes the motion of a moving object relative to a surface ✓✓

Die krag wat die beweging van 'n bewegende voorwerp relatief tot 'n oppervlak teenwerk.

(2)

3.2



Accepted labels/*Aanvaarde benoemings*	
w	F_w / F_g / mg /39,2 N / gravitational force / *gravitasiekrag / weight / gewig*
f	F_f / f_k / (kinetic) Friction / *(kinetiese) wrywing*
N	F_N / Normal force / *Normaalkrag*
F	F_A / Applied force /*Toegepaste krag* / F_{toe} (Afrikaans)

Notes/*Aantekeninge*:

- Mark awarded for label and arrow./*Punt toegeken vir benoeming en pyltjie*.
- Do not penalize for length of arrows since drawing is not to scale*./Moenie vir die lengte van die pyltjies penaliseer nie aangesien die tekening nie volgens skaal is nie.*
- Any other additional force(s)/*Enige ander addisionele krag(te):* Max/*Maks* ¾
- If everything is correct, but no arrows/*Indien alles korrek is, maar geen pyltjies:* Max/*Maks* ¾
- If force(s) do not make contact with the dot /*Indien krag(te) nie met die kolletjie kontak maak nie*: Max/*Maks* ¾
- If components drawn for F/*Indien komponente van F geteken*: Max/*maks* ¾

(4)

3.3.1

OPTION 1/ *OPSIE 1*	**OPTION 2/ *OPSIE 2***
$f_k = \mu_k N$ ✓	$f_k = \mu_k N$ ✓
$f_k = (0,1)(44,13\sin 19,9°)$✓	$f_k = (0,1)(44,13\text{Cos}70,1°)$✓
$f_k = 1,5021$ N ✓	$f_k = 1,5021$ N ✓

(3)

3.3.2

OPTION 1/ *OPSIE 1*	
Upwards as positive ***Opwaarts as positief***	**Upwards as negative** ***Opwaarts as negatief***
$F_{net} = ma$ ✓ $\underline{44,13\cos 19,9° - 1,5021 - 39,2}$ ✓$= 4a$✓ $a = 0,1982$ m·s^{-2} $\Delta y = V_i\Delta t + \frac{1}{2}a\Delta t^2$ $\Delta y = (1,45)(0,5) + \frac{1}{2}(0,1982)(0,5)^2$✓ $\Delta y = 0,7498$ m ✓	$F_{net} = ma$ ✓ $\underline{-44,13\cos 19,9° + 1,5021 + 39,2}$ ✓$= 4a$✓ $a = -0,1982$ m·s^{-2} $\Delta y = V_i\Delta t + \frac{1}{2}a\Delta t^2$ $\Delta y = (-1,45)(0,5) + \frac{1}{2}(-0,1982)(0,5)^2$✓ $\Delta y = -0,7498$ m $\therefore \Delta y = 0,7498$ m ✓
OPTION 2/ *OPSIE 2*	
Upwards as positive ***Opwaarts as positief***	**Upwards as negative** ***Opwaarts as negatief***
$F_{net} = ma$ ✓ $\underline{44,13\sin 70,1° - 1,5021 - 39,2}$ ✓$= 4a$✓ $a = 0,1982$ m·s^{-2} $\Delta y = V_i\Delta t + \frac{1}{2}a\Delta t^2$ $\Delta y = (1,45)(0,5) + \frac{1}{2}(0,1982)(0,5)^2$✓ $\Delta y = 0,7498$ m ✓	$F_{net} = ma$ ✓ $\underline{-44,13\sin 70,1° + 1,5021 + 39,2}$ ✓$= 4a$✓ $a = -0,1982$ m·s^{-2} $\Delta y = V_i\Delta t + \frac{1}{2}a\Delta t^2$ $\Delta y = (-1,45)(0,5) + \frac{1}{2}(-0,1982)(0,5)^2$✓ $\Delta y = -0,7498$ m $\therefore \Delta y = 0,7498$ m ✓

(5)

3.4 DECREASES ✓

The magnitude of the <u>normal force decreases</u> ✓

NEEM AF

Die grootte van die <u>normaalkrag neem af</u>.

(2)
[16]

QUESTION 4 / *VRAAG 4*

4.1

Marking criteria/Nasienkriteria
If any one of the underlined key phrases in the correct context is omitted, deduct 1 *mark/Indien enige van die onderstreepte frases in die korrekte konteks uitgelaat is, trek 1 punt af.*

Motion during which the only (force) acting on an object is the gravitational force ✓✓

Beweging waartydens die enigste krag wat op 'n voorwerp inwerk, die gravitasiekrag is.

(2)

4.2.1

OPTION 1/ OPSIE 1	
Upward as positive Opwaarts is positief	**Upward as negative Opwaarts is negatief**
$10 = \frac{1}{2}(t)(14)$ ✓ t = 1,4286 s✓	$-10 = \frac{1}{2}(t)(-14)$ ✓ t = 1,4286 s✓
OPTION 2/ OPSIE 2	
$-9,8 = \frac{0-14}{t-0}$ ✓ t = 1,4286 s✓	$9,8 = \frac{0-(-14)}{t-0}$ ✓ t = 1,4286 s✓

(2)

4.2.2

OPTION 1/ OPSIE 1	
Upward as positive Opwaarts is positief	**Upward as negative Opwaarts is negatief**
$v_f = v_i + a\Delta t$ ✓ $v_f = 14 + (-9,8)(5)$✓ $v_f = -35\ m{\cdot}s^{-1}$ $\therefore v_f =$ 35 m·s^{-1} downwards ✓	$v_f = v_i + a\Delta t$ ✓ $v_f = -14 + (9,8)(5)$✓ $v_f =$ 35 m·s^{-1} downwards / *afwaarts*✓
OPTION 2/ OPSIE 2	
$v_f = v_i + a\Delta t$ ✓ $v_f = 0 + (-9,8)(3,5714)$✓ $v_f = -35\ m{\cdot}s^{-1}$ $\therefore v_f =$ 35 m·s^{-1} downwards/ *afwaarts* ✓	$v_f = v_i + a\Delta t$ ✓ $v_f = 0 + (9,8)(3,5714)$✓ $v_f =$ 35 m·s^{-1} downwards/ *afwaarts* ✓

(3)

OPTION 3/ *OPSIE 3*	
$v_f = v_i + a\Delta t$ ✓ $v_f = -14 + (-9,8)(2,1428)$✓ $v_f = -34,999\ m\cdot s^{-1}$ $\therefore v_f =$ 34,999 m·s^{-1} downwards/ *afwaarts* ✓	$v_f = v_i + a\Delta t$ ✓ $v_f = 14 + (9,8)(2,1428)$✓ $v_f =$ 34,999 m·s^{-1} downwards/ *afwaarts* ✓

OPTION 4/ *OPSIE 4*	
$v_f^2 = v_i^2 + 2a\Delta y$✓ $v_f^2 = (0)^2 + 2(-9,8)(-62,5)$✓ $v_f =$ 35 m·s^{-1} downwards/ *afwaarts* ✓	$v_f^2 = v_i^2 + 2a\Delta y$✓ $v_f^2 = (0)^2 + 2(9,8)(62,5)$✓ $v_f =$ 35 m·s^{-1} downwards/ *afwaarts* ✓
OPTION 5/ *OPSIE 5*	
$v_f^2 = v_i^2 + 2a\Delta y$✓ $v_f^2 = (14)^2 + 2(-9,8)(-52,5)$✓ $v_f =$ 35 m·s^{-1} downwards/*afwaarts* ✓	$v_f^2 = v_i^2 + 2a\Delta y$✓ $v_f^2 = (-14)^2 + 2(9,8)(52,5)$✓ $v_f =$ 35 m·s^{-1} downwards/*afwaarts* ✓
OPTION 6/ *OPSIE 6*	
$F_{net}\cdot\Delta t = \Delta p$ ✓ $(-9,8)(5) = v_f - 14$ ✓ $v_f =$ 35 m·s^{-1} downwards/*afwaarts* ✓	$F_{net}\cdot\Delta t = \Delta p$ ✓ $(-9,8)(5) = v_f - (-14)$ ✓ $v_f =$ 35 m·s^{-1} downwards/*afwaarts* ✓
OPTION 7/ *OPSIE 7*	
$-62,5$ ✓$= \frac{1}{2}(3,5714)(v)$ ✓ $v_f = -35\ m\cdot s^{-1}$ $v_f =$ 35 m·s^{-1} downwards/ *afwaarts* ✓	$62,5$ ✓$= \frac{1}{2}(3,5714)(-v)$ ✓ $v_f =$ 35 m·s^{-1} downwards/ *afwaarts* ✓
OPTION 8/ OPSIE 8	
$-9,8$ ✓$= \frac{-v-14}{5-0}$ ✓ $v_f = -35\ m\cdot s^{-1}$ $v_f =$ 35 m·s^{-1} downwards/ *afwaarts* ✓	$9,8$ ✓$= \frac{v-(-14)}{5-0}$ ✓ $v_f =$ 35 m·s^{-1} downwards/ *afwaarts* ✓

4.3

Marking criteria/*Nasienkriteria*

If any one of the underlined key phrases in the correct context is omitted, deduct 1 *mark/Indien enige van die onderstreepte frases in die korrekte konteks uitgelaat is, trek 1 punt af.*

The net (or resultant) force acting on an object is equal to the rate of change of momentum of the object in the direction of the net force.✓✓

Die netto krag wat op 'n voorwerp inwerk, is gelyk aan die tempo van verandering van momentum van die voorwerp in die rigting van die netto krag.

(2)

4.4 **POSITIVE MARKING FROM QUESTION 4.2.2.**
POSITIEWE NASIEN VANAF VRAAG 4.2.2.

Upward as positive ***Opwaarts is positief***	**Upward as negative** ***Opwaarts is negatief***
$F_{net} \cdot \Delta t = \Delta p$ ✓	$F_{net} \cdot \Delta t = \Delta p$ ✓
$F_{net}(0,2) = 0,25\ (12 - (-35))$ ✓	$F_{net}(0,2) = 0,25\ (-12 - 35)$ ✓
$F_{net} = 58,75$ N	$F_{net} = -58,75$ N
$F_s - (0,25)(9,8) = 58,75$ ✓	$F_s + (0,25)(9,8) = -58,75$ ✓
$F_s = 61,2$ N ✓	$F_s = -61,2$ N
	$\therefore F_s = 61,2$ N ✓

(4)

4.5

Marking criteria:

• Correct shape of the graph ✓

• Correct value of acceleration (9,8) and graph correctly labelled ✓

Note:

Graph not labelled: max. ½

Nasienkriteria:

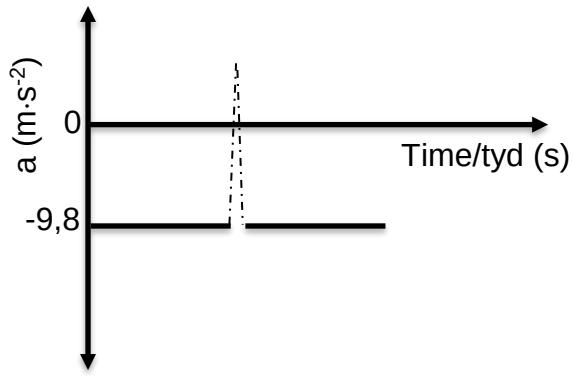
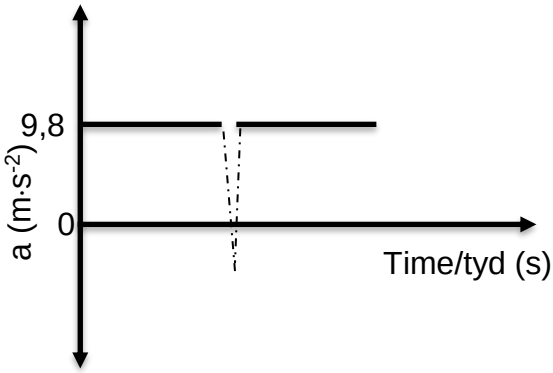
• *Korrekte vorm* ✓

• *Korrekte waarde vir versnelling (9,8) en grafiek is reg benoem* ✓

Nota:

Grafiek nie benoem: maks. ½

(2)

Upwards as positive ***Opwaarts as positief***	**Upwards as negative** ***Opwaarts as negatief***
	

[15]

QUESTION 5 / *VRAAG 5*

5.1 Vector quantity with the same direction as the velocity of the object ✓✓

'n Vektorgrootheid met dieselfde rigting as die snelheid van die voorwerp.

(2)

5.2.1

East as positive/ *Oos as positief*	**East as negative/ *Oos as negatief***
$p = mv$ ✓	$p = mv$ ✓
$4 = m(10)$ ✓	$-4 = m(-10)$ ✓
$m = 0,4$ kg ✓	$m = 0,4$ kg ✓

(3)

5.2.2

OPTION 1/ *OPSIE 1*	
East as positive ***Oos as positief***	**East as negative** ***Oos as negatief***
$\Delta p = p_f - p_i$ ✓	$\Delta p = p_f - p_i$ ✓
$-5,2 = 0,4v_f - 4$ ✓	$5,2 = 0,4v_f - (-4)$ ✓
$V_f = -3$ m·s^{-1}	$\therefore V_f =$ 3 m·s^{-1} WEST/ *WES* ✓
$\therefore V_f =$ 3 m·s^{-1} WEST/ *WES* ✓	
OPTION 2/ *OPSIE 2*	
$\Delta p = m(v_f - v_i)$ ✓	$\Delta p = m(v_f - v_i)$ ✓
$-5,2 = 0,4(v_f - 10)$ ✓	$5,2 = 0,4(v_f - (-10))$ ✓
$v_f = -3$ m·s^{-1}	$v_f = 3$ m·s^{-1}
$\therefore v_f =$ 3 m·s^{-1} WEST ✓	$\therefore v_f =$ 3 m·s^{-1} WEST ✓

(3)

[08]

QUESTION 6 / *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 van die onderstreepte frases in die korrekte konteks uitgelaat is, trek 1 punt af.*

A series of organic compounds that can be described by the same general formula ✓✓

OR

Series of organic compounds in which one member differs from the next with a CH_2 group

'n Reeks organiese verbindings wat deur dieselfde algemene formule beskryf kan word.

OF

'n Reeks organiese verbindings waarin een lid van die volgende verskil met 'n CH_2-groep.

(2)

6.2.1 B ✓ (1)

6.2.2 D ✓ (1)

6.3.1

Marking criteria:

- Correct stem, i.e. butane. ✓
- Correct substituents (fluoro and dimethyl) identified. ✓
- IUPAC name completely correct including numbering, sequence, hyphens and commas. ✓

Nasienkriteria:

- *Korrekte stam, d.i. butaan.* ✓
- *Korrkete substituente fluoro and dimethyl) geïdentifiseer.* ✓
- *IUPAC naam heeltemal korrek, wat nommering, volgorde, koppeltekens en kommas bevat* ✓

3–fluoro–2,2–dimethylbutane ✓✓✓

3–fluoro–2,2–dimethylbutaan ✓✓✓

(3)

6.3.2 SECONDARY ✓

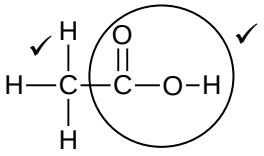
The halogen/fluorine/(-X)/ is bonded to a C atom that (functional group) is bonded to two other C atoms ✓

SEKONDÊR

Die halogeen/ fluoor/ funskionele groep (-X) is aan 'n C gebind wat aan twee ander C gebind is.

(2)

6.4



Marking criteria:

• Functional group correct. ✓

• Whole structural formula correct. ✓

If CORRECT condensed structural formula used: max: ½

Nasienkriteria:

• *Funksionele groep korrek.* ✓

• *Hele struktuurformule korrek.* ✓

(2)

6.5 $C_3H_8 + 5O_2$ ✓$\rightarrow 3CO_2 + 4H_2O$ ✓ Bal. ✓

Ignore phases/*Ignoreer fases*

Marking criteria:

- Correct chemical formulae of reactants ($C_3H_8 + O_2$) ✓
- Correct chemical formulae of products ($CO_2 + H_2O$) ✓
- Correct balancing. ✓
- Marking rule 6.3.10 is applied.

Nasienkriteria:

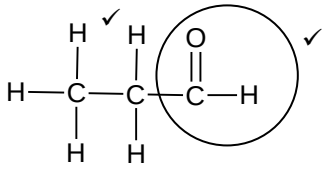
- *Korrekte chemiese formule van reaktante* ($C_3H_8 + O_2$) ✓
- *Korrekte chemiese formule van produkte* ($CO_2 + H_2O$) ✓
- *Korrekte balansering*. ✓
- Nasienreël 6.3.10

(3)

6.6.1 Carbonyl (group) ✓ (1)

Karboniel(groep)

6.6.2



✓ ✓

Marking criteria:

- Functional group correct. ✓
- Whole structural formula correct. ✓

If CORRECT condensed structural formula used: max: ½

Nasienkriteria:

- *Funksionele groep korrek.* ✓
- *Hele struktuurformule korrek.* ✓

(2)

6.6.3

$$\%O = \frac{16}{58} \times 100 \checkmark$$

$$\%O = 27{,}586\ \% \checkmark$$

(2)

[19]

QUESTION 7 / *VRAAG 7*

7.1

Marking criteria/Nasienkriteria

If any one of the underlined key phrases in the correct context is omitted, deduct 1 *mark/Indien enige van die onderstreepte frases in die korrekte konteks uitgelaat is, trek 1 punt af.*

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)

7.2.1 1,013 ✓(x10^5 Pa)

Accept/ *Aanvaar*: 101,3 kPa or 760 mmHg or 1 atm (1)

7.2.2 $CH_3CH_2CH_2CH_2CH_3$ ✓✓

OR/ OF

$CH_3(CH_2)_3CH_3$ ✓✓ (2)

7.2.3 Formyl (group) ✓✓
Formiel(groep) ✓✓ (2)

7.3 **B** ✓

Higher boiling point/lower vapour pressure/B has dipole-dipole force and A has london forces ✓

B

Hoër kookpunt/ laer dampdruk (2)

7.4

Marking criteria:

- Compare structures. ✓✓
- Compare the strength of intermolecular forces. ✓
- Compare the energy required to overcome intermolecular forces. ✓

Nasienkriteria:

- *Vergelyk strukture.* ✓✓
- *Vergelyk die sterkte van intermolekulêre kragte.* ✓
- *Vergelyk die energie benodig om intermolekulêre kragte te oorkom.* ✓

OPTION 1

- **Structure:**
  Compound **C** has one site for hydrogen bonding✓, whilst compound **D** has two sites for hydrogen bonding ✓
- **Intermolecular forces:**
  Compound **D** has stronger intermolecular forces ✓ (than compound **C**)
- **Energy:**
  More energy needed to overcome intermolecular forces in compound **D** ✓(than in compound **C**)

(4)

OPSIE 1

- ***Struktuur:***
  *Verbinding **C** het een plek vir 'n waterstofbinding ✓, waar Verbinding D twee plekke het vir waterstofbings. ✓*
- ***Intermolekulêre kragte***
  *Verbinding **D** het sterker intermolekulêre kragte ✓ (as verbinding **C**).*
- ***Energie:***
  *Meer energie word benodig om die intermolekulêre kragte van verbinding **D** te oorkom ✓ (as verbinding **C**).*

OPTION 2

- **Structure:**
  Compound **C** has one site for hydrogen bonding✓, whilst compound **D** has two sites for hydrogen bonding ✓
- **Intermolecular forces:**
  Compound **C** has weaker intermolecular forces ✓ (than compound **D**)
- **Energy:**
  Lesser energy needed to overcome intermolecular forces in compound **C** ✓(than in compound **D**)

OPSIE 2

- ***Struktuur:***
  *Verbinding **C** het een plek vir 'n waterstofbinding ✓, waar Verbinding D twee plekke het vir waterstofbings. ✓*
- ***Intermolekulêre kragte***
  *Verbinding **C** het swakker intermolekulêre kragte ✓ (as verbinding **D**).*
- ***Energie:***
  *Minder energie word benodig om die intermolekulêre kragte van verbinding **C** te oorkom ✓ (as verbinding **D**).*

[13]

QUESTION 8 / *VRAAG 8*

8.1.1 Dehydrohalogenation (Dehydrobromination) ✓
Dehidrohalogenering ✓ (1)

8.1.2 **ANY ONE:**

- Concentrated strong base (NaOH/KOH/LiOH) ✓
- Strong heat ✓

ENIGE EEN

- *Gekonsentreerde sterk basis (NaOH/KOH/LiOH)* ✓
- *Sterk verhitting* ✓ (1)

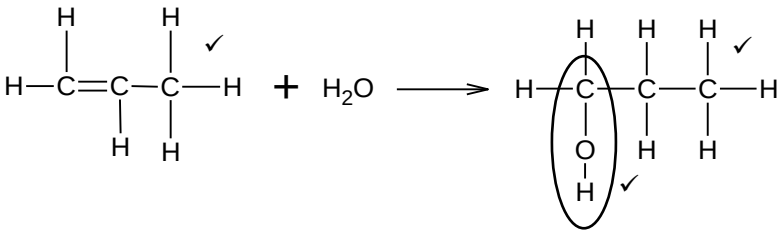
8.1.3 C_3H_6 ✓ (1)

8.1.4 NaBr/Sodium bromide/ *Natriumbromied* ✓ (1)

8.2.1 Addition✓ (Accept: Hydration)
Addisie (Aanvaar: Hidrasie) (1)

8.2.2 H_2SO_4/H_3PO_4 ✓ (1)

8.2.3



Marking criteria:

• Correct structural formula of propene ✓
• Correct functional group of the product (alcohol) ✓
• Whole structural formula of propan-1-ol correct ✓

Note:

If H_2O is omitted/for extra product or reactant, deduct 1 mark

Nasienkriteria

• *Korrkete struktuurformule van propeen* ✓
• *Korrekte funksionele groep van propan-1-ol.* ✓
• *Hele struktuurformule van propan-1-ol is korrek.* ✓

Nota:

Indien H_2O uitgelaat is/ daar is 'n ekstra reactant of produk, trek 1 punt af (3)

8.3.1 Condensation ✓
Kondensasie
Accept: Esterification
Aanvaar: *Esterifikasie* (1)

8.3.2 Propanoic acid ✓
Propanoësuur (1)

8.3.3 H_2O/Water ✓ (1)
[12]

GRAND TOTAL: 100