



education
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

FURTHER EDUCATION AND TRAINING
VERDERE ONDERWYS EN OPLEIDING

GRADE / GRAAD 11

PHYSICAL SCIENCES / FISIESE WETNSKAPPE
MARKING GUIDELINES / NASIENRIGLYNE
SEPTEMBER TEST / TOETS 2026

MARKS / PUNTE: 100

These marking guidelines consists of 10 pages.

Hierdie nasienriglyne bestaan uit 10 bladsye.

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Please turn over

QUESTION / VRAAG 1

1.1 D ✓✓ (2)

1.2 C ✓✓ (2)

1.3 C ✓✓ (2)

[06]

QUESTION / VRAAG 2

2.1 Is the number of particles (atoms, molecules, formula units) present in one mole ($N_A = 6,023 \times 10^{23} \text{ particles} \cdot \text{mol}^{-1}$) ✓✓

Is die aantal deeltjies (atome, molekules, formule-eenhede) wat in een mol teenwoordig is ($N_A = 6,023 \times 10^{23} \text{ deeltjies} \cdot \text{mol}^{-1}$)

(2)

2.2 Temperature / Temperatuur = 0°C (273 K) ✓

Pressure / Druk = 1 atmosphere (101,3 kPa) ✓

(2)

2.3

2.3.1

$n = \frac{V}{V_M} = \frac{0,3}{22,4} \checkmark$ $n = 0,013 \text{ mol}$	$\frac{n(\text{CaCl}_2)}{n(\text{CO}_2)} = \frac{1}{1} \checkmark$ $n(\text{CO}_2) = 0,013 \text{ mol}$
$n = \frac{N}{N_A} \checkmark$ $0,013 = \frac{N}{6,02 \times 10^{23}} \checkmark$ $N = 7,826 \times 10^{21} \text{ molecules of CaCl}_2$ $\therefore N(\text{Cl atoms}) = (7,826 \times 10^{21})(2) = 1,5652 \times 10^{22} \text{ atoms} \checkmark$	

(5)

2.3.2

$\frac{n(\text{HCl})}{n(\text{CO}_2)} = \frac{2}{1}$ $\frac{n(\text{HCl})}{1} = \frac{2}{1} (0,013) \checkmark$ $n(\text{HCl}) = 0,026 \text{ mol}$	$c = \frac{n}{V} \checkmark$ $0,2 = \frac{0,026}{V} \checkmark$ $V = 0,13 \text{ dm}^3 \checkmark$
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(4)

2.3.3

$$\frac{n(\text{CaCO}_3)}{n(\text{CO}_2)} = \frac{1}{1} \checkmark$$

$$n(\text{CaCO}_3) = 0,013 \text{ mol} \checkmark$$

(2)

[15]

QUESTION / VRAAG 3

- 3.1 Is the amount of solute per litre of solution. ✓✓
Is die hoeveelheid opgeloste stof per liter oplossing. (2)

3.2

OPTION / OPSIE 1	OPTION / OPSIE 2
$c = \frac{m}{MV}$ ✓	$n = \frac{m}{M} = \frac{0,4}{106}$ ✓
$c = \frac{0,4}{(106) \times (0,5)}$ ✓	$n = 0,00377 \text{ mol}$
$c = 0,0075 \text{ mol} \cdot \text{dm}^{-3}$ ✓	$c = \frac{n}{V}$ ✓
$(0,01 \text{ mol} \cdot \text{dm}^{-3})$	$c = \frac{0,00377}{0,5}$ ✓
	$c = 0,0075 \text{ mol} \cdot \text{dm}^{-3}$ ✓
	$(0,01 \text{ mol} \cdot \text{dm}^{-3})$

 (4)

- 3.3 HIGHER THAN / HOËR AS ✓
- For the same number of moles of solute ✓ , when the volume decreases the concentration increases ✓
 - Vir dieselfde aantal mol opgeloste stof , neem die konsentrasie toe wanneer die volume afneem.

(3)
[09]

QUESTION / VRAAG 4

- 4.1 Is the simplest whole-number ratio of atoms in a compound ✓✓
Is die eenvoudigste heelgetal verhouding van atome in 'n verbinding. (2)
- 4.2.1 CH_2O ✓✓ (2)

4.2.2

OPTION1 / OPSIE 1 (C ₆ H ₁₂ O ₆)		
M(C) = 6(12) = 72 g·mol ⁻¹	M(H) = 12(1) = 12 g·mol ⁻¹	M(O) = 6O = 6(16) = 96 g·mol ⁻¹
M(C ₆ H ₁₂ O ₆) = 180 g·mol ⁻¹ ✓		
%C = $\frac{72}{180} \times 100$ %H = 40 %✓	%H = $\frac{12}{180} \times 100$ %S = 6,67 %✓	%O = $\frac{96}{180} \times 100$ %O = 53,33 %✓

OPTION2 / OPSIE 2 (CH ₂ O)		
M(C) = 1(12) = 12 g·mol ⁻¹	M(H) = 2(1) = 2 g·mol ⁻¹	M(O) = 1(16) = 16 g·mol ⁻¹
M(CH ₂ O) = 30 g·mol ⁻¹ ✓		
%C = $\frac{12}{30} \times 100$ %H = 40 %✓	%H = $\frac{2}{30} \times 100$ %S = 6,67 %✓	%O = $\frac{16}{30} \times 100$ %O = 53,33 %✓

(4)

4.3

K	C	O
N = 8,724 x10 ²³	n = 0,725 mol	m = 34,78 g
$n = \frac{N}{N_A} = \frac{8,724 \times 10^{23}}{6,02 \times 10^{23}}$ ✓ n = 1,449 mol	n = 0,725 mol	$n = \frac{m}{M} = \frac{34,78}{16}$ ✓ n = 2,173 mol
$\frac{1,449}{0,725}$	$\frac{0,725}{0,725}$	$\frac{2,173}{0,725}$ ✓✓
2	1	3 ✓
K ₂ CO ₃ ✓		

(6)
[14]

QUESTION / VRAAG 5

5.1 Hydrogen / Waterstof ✓✓

(2)

5.2

X_2	H_2
$N = 1,204 \times 10^{23}$	$m = 1,6 \text{ g}$
$n = \frac{N}{N_A} = \frac{1,204 \times 10^{23}}{6,02 \times 10^{23}} \checkmark$ $n = 0,2 \text{ mol}$	$n = \frac{m}{M} = \frac{1,6}{2} \checkmark$ $n = 0,8 \text{ mol}$

$$n(XY_3) = 2n(X_2) = 2(0,2) \checkmark = 0,4 \text{ mol}$$

$$n(XY_3) = \frac{2}{3}n(H_2) = \frac{2}{3}(0,8) \checkmark = 0,53 \text{ mol}$$

X_2 is the limiting reagent / is die beperkte reaktans. ✓

NOTE: Accept any correct method used to determine the limiting reagent.

LET WEL: Aanvaar enige korrekte metode wat gebruik word om die beperkte reaktans te bepaal.

(5)

5.3 $n(H_2)_{\text{reacted}} / \text{gereageer} = 3n(X_2) = 3(0,2) \checkmark = 0,6 \text{ mol}$

$$n(H_2)_{\text{excess}} / \text{oormaat} = 0,8 - 0,6 \checkmark \checkmark$$

$$n(H_2)_{\text{excess}} / \text{oormaat} = 0,2 \checkmark (\text{mol})$$

(4)

5.4

OPTION 1/OPSIE 1
$n(XY_3)_{\text{formed}} / \text{gevorm} = 2n(X_2) = 2(0,2) \checkmark = 0,4 \text{ mol}$ Theoretical yield / Teoretiese opbrengs = $\frac{6,12}{90} \times 100 \checkmark = 6,8 \text{ g}$ $n = \frac{m}{M}$ $0,4 = \frac{6,8}{M} \checkmark$ $M(XY_3) = 17 \text{ g} \cdot \text{mol}^{-1}$ $X + 3(1) = 17 \quad \therefore X = 14 \text{ g} \cdot \text{mol}^{-1} \checkmark$ $\therefore X \text{ is N (Nitrogen / Stikstof) } \checkmark$

(5)

OPTION / OPSIE 2
$n(XY_3) = \frac{2}{3} n(H_2) = \frac{2}{3} (0,6) \checkmark = 0,4 \text{ mol}$ $\text{Theoretical yield / Teoretiese opbrengs} = \frac{6,12}{90} \times 100 \checkmark = 6,8 \text{ g}$ $n = \frac{m}{M}$ $0,4 = \frac{6,8}{M} \checkmark$ $M(XY_3) = 17 \text{ g} \cdot \text{mol}^{-1}$ $X + 3(1) = 17$ $X = 14 \text{ g} \cdot \text{mol}^{-1} \checkmark \quad \therefore X \text{ is N (Nitrogen / Stikstof) } \checkmark$

[16]

QUESTION / VRAAG 6

- 6.1 One mole of any gas occupies the same volume at the same temperature and pressure ✓✓

Een mol van enige gas neem dieselfde volume in beslag by dieselfde temperatuur en druk.

(2)

6.2

CO ₂ (g)	H ₂ O(g)
$\frac{V(\text{CO}_2)}{V(\text{CH}_4)} = \frac{1}{1}$ $V(\text{CO}_2)_{\text{formed}} = 20 \text{ cm}^3 \checkmark$	$\frac{V(\text{H}_2\text{O})}{V(\text{CO}_2)} = \frac{2}{1}$ $V(\text{H}_2\text{O})_{\text{formed}} = \frac{2}{1} (20) \checkmark$ $V(\text{H}_2\text{O}) = 40 \text{ cm}^3$
$\text{Total volume formed} = V(\text{CO}_2) + V(\text{H}_2\text{O})$ $\text{Total volume} = 20 + 40 \checkmark$ $\text{Total volume} = 60 \text{ cm}^3 \checkmark$	

(4)
[06]

QUESTION / VRAAG 7

7.1 Is the unstable transition state from reactants to products. ✓✓ (2)
Is die onstabiele oorgangstoestand van reaktanse na produkte.

7.2 Activation energy / Aktiveringsenergie ✓✓ (2)

7.3

7.3.1 $40 = 60 - R$ ✓ OR/OF $60 = R + 40$
 $R = 20$ ✓ ($\text{kJ}\cdot\text{mol}^{-1}$) (2)

7.3.2 $\Delta H = H_{\text{products}} - H_{\text{reactants}}$ ✓
 $\Delta H = 5 - 20$ ✓
 $\Delta H = -15 \text{ kJ}\cdot\text{mol}^{-1}$ ✓ (3)

7.4 MORE ENERGY RELEASED THAN ABSORBED ✓

Meer energie vrygestel as geabsorbeer.

- $\Delta H < 0$ / ΔH is negative / $\Delta H = -15 \text{ kJ}\cdot\text{mol}^{-1}$ ✓

Accept: Reaction is exothermic ✓

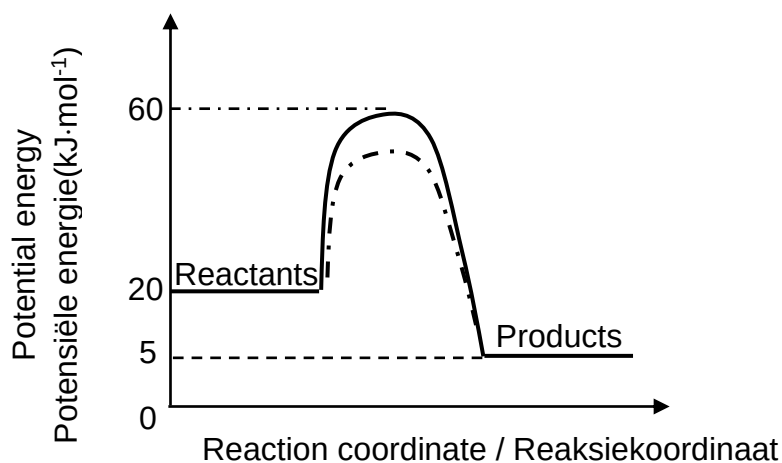
Aanvaar: Reaksie is eksotermies (2)

7.5.1 DECREASES / AFNEEM ✓

- A catalyst creates an alternative path of lower activation energy
(A catalyst lowers/decreases the activation energy) ✓
- 'n Katalisator skep 'n alternatiewe roete met 'n laer
aktiveringsenergie ('n Katalisator verlaag die aktiveringsenergie). (2)

7.5.2 REMAINS THE SAME / BLY DIESELFDE ✓ (1)

7.6



(3)

Marking criteria:

- The peak of the dotted line is below the solid line ✓
- The energy of product and reactants remained the same ✓
- The value of the energy of reactants calculated in 7.3.1 is indicated on the graph ✓

Nasienkriteria:

- Die piek van die stippellyn is onder die soliede lyn.
- Die energie van die produk en reaktanse het dieselfde gebly.
- Die waarde van die energie van reaktanse wat in 7.3.1 bereken is, word op die grafiek aangedui.

[17]

QUESTION / VRAAG 8

8.1 Is a substance that produces hydroxide ions (OH^-) when it dissolves in water ✓✓

Is 'n stof wat hidroksiedione (OH^-) lewer wanneer dit in water oplos. (2)

8.2.1 $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l}) \rightarrow 2\text{H}_3\text{O}^+(\text{aq}) + \text{SO}_4^{2-}(\text{aq})$ ✓ Bal. ✓

Marking criteria:

- Correct reactants ✓
- Correct products ✓
- Correct balancing including the charges ✓

NOTE: ignore phases

Nasienkriteria:

- Korrekte reaktanse
- Korrekte produkte
- Korrekte balansering, insluitend die ladings

LET WEL: ignoreer fases

(3)

8.2.2

OPTION / OPSIE 1	OPTION / OPSIE 2
$c = \frac{m}{MV} \checkmark$ $c = \frac{0,3}{(40)\checkmark(2)} \checkmark$ $c = 0,00375 \text{ mol}\cdot\text{dm}^{-3}$	$n = \frac{m}{M} = \frac{0,3}{40} \checkmark$ $n = 0,0075 \text{ mol}$ $c = \frac{n}{V} \checkmark$ $c = \frac{0,0075}{2} \checkmark$ $c = 0,00375 \text{ mol}\cdot\text{dm}^{-3}$
$[\text{OH}^-] = [\text{NaOH}] = 0,00375 \text{ mol}\cdot\text{dm}^{-3}$ $[\text{H}_3\text{O}^+][\text{OH}^-] = 1 \times 10^{-14}$ $[\text{H}_3\text{O}^+](0,00375) = 1 \times 10^{-14} \checkmark$ $[\text{H}_3\text{O}^+] = 2,667 \times 10^{-12}$ $\text{pH} = -\log[\text{H}_3\text{O}^+] \checkmark$ $\text{pH} = -\log(2,667 \times 10^{-12}) \checkmark$ $\text{pH} = 11,574 \checkmark$	

(7)

8.2.3 H_2O ✓✓

(2)

8.3 $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \checkmark \rightarrow \text{Na}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\ell) \checkmark$ Bal. ✓**Marking criteria:**

- Correct reactants ✓
- Correct products ✓
- Correct balancing including the charges ✓

NOTE: ignore phases**Nasienkriteria:**

- Korrekte reaktanse
- Korrekte produkte
- Korrekte balansering, insluitend die ladings

LET WEL: ignoreer fases(3)
[17]**TOTAL/TOTAAL 100**

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