



LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES **MARKING GUIDELINES** PREPARATORY EXAMINATION

SEPTEMBER 2026

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SEPTEMBER 2026

MARKS / PUNTE: 150

TIME / TYD: 3 Hours / Ure

These Marking Guidelines consist of 16 pages including the cover page

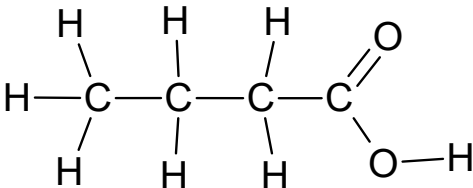
Hierdie merkriglyne bestaan uit 16 bladsye, insluitend die voorblad.

QUESTION 1 / VRAAG 1

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

[20]

QUESTION 2 / VRAAG 2

- 2.1.1 2,2,4 - trimethylpentane✓✓✓
2,2,4 - trimetielpentaan✓✓✓ (3)
- 2.1.2 5 – bromo - 4 - chlorohept - 3 - yne✓✓✓
5 – bromo – 4 – chlorohept – 3 – yn ✓✓✓ (3)
- 2.1.3 Hexan - 2 - one✓✓
Heksan – 2 – oon ✓✓ (2)
- 2.2 D and / en E✓
F and / en G✓ (2)
- 2.3 Esters (1)
- 2.4  (2)
- 2.5 $\underline{2C_8H_{18} + 25O_2} \rightarrow \underline{16CO_2 + 18H_2O}$ ✓ (✓ balancing / balansering) (3)
- 2.6 Exothermic.✓
Energy is released/ energy is one of the products. ✓
Eksotermies. ✓
Energie word vrygestel/ energie is een van die produkte. ✓ (2)

[18]

QUESTION 3 / VRAAG 3

- 3.1 Vapour pressure is the pressure exerted by vapour in equilibrium with its liquid in a closed system. ✓✓
Dampdruk is die druk wat deur damp in ewewig met sy vloeistof in 'n geslote sisteem uitgeoefen word. ✓✓ (2)
- 3.2.1 Vapour pressure. ✓
Damp druk ✓ (1)
- 3.2.2 Molar mass/size of molecule. ✓
Molêre massa/grootte van molekule ✓ (1)
- 3.3 A. ✓ (1)
- 3.4 A. ✓
A has hydrogen bonding ✓
while B has dipole – dipole forces. ✓
Hydrogen bonds are stronger than dipole – dipole forces. ✓
More energy needed to overcome intermolecular forces in compound A than in compound B. ✓

A ✓
A het waterstofbinding ✓
terwyl B dipool-dipoolkragte het. ✓
Waterstofbindings is sterker as dipool-dipoolkragte. ✓
Meer energie benodig om intermolekulêre kragte in verbinding A te oorkom as in verbinding B. ✓ (5)

- 3.5 Compound D is more branched/compact than compound C✓ resulting in
compound D having a smaller surface area than compound C.✓
Compound D has weaker intermolecular forces than compound C.✓
Hence, less energy is needed to overcome intermolecular forces in
compound D than in compound C.✓
- Verbinding D is meer vertak/kompak as verbinding C, ✓
wat daartoe lei dat verbinding D 'n kleiner oppervlakarea het as
verbinding C. ✓
- Verbinding D het swakker intermolekulêre kragte as verbinding C. ✓
Gevolglik is minder energie nodig om intermolekulêre kragte in verbinding
D te oorkom as in verbinding C. ✓

(4)

[14]

QUESTION 4 / VRAAG 4

4.1 Reaction 1: Dehydration/elimination✓

Reaction 3: Dehydrohalogenation/elimination✓

Reaction 5: Elimination✓

Reaction 7: Cracking✓

Reaksie 1: Dehidrasie/eliminasi✓

Reaksie 3: Dehidrohalogenering/eliminasi✓

Reaksie 5: Eliminasi✓

Reaksie 7: Kraking✓

(4)

4.2 SECONDARY✓

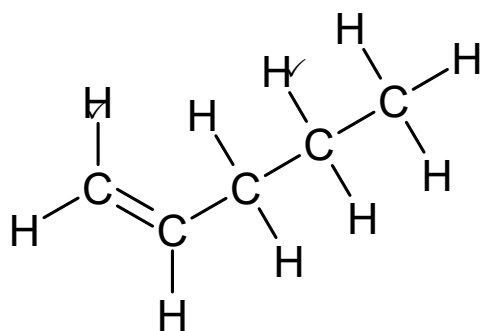
The Carbon atom that carries the Br is bonded to two other carbon atoms.✓✓

SEKONDÊRE ✓

Die koolstofatoom wat die Br dra, is aan twee ander koolstofatome gebind. ✓✓

(3)

4.3.1

**Marking criteria**

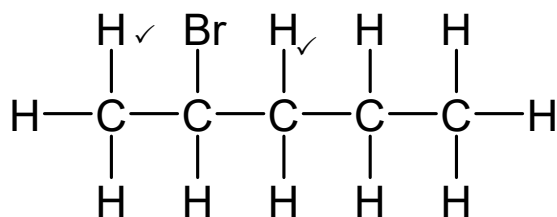
- ✓ Functional group
- ✓ Whole structure correct

Merk kriteria

- ✓ Funksionele groep
- ✓ Hele struktuur korrek

(2)

4.3.2

**Marking criteria**

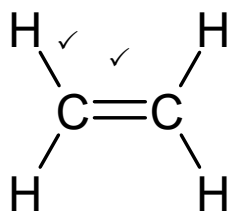
- ✓ Br on second C
- ✓ Whole structure correct

Merk kriteria

- ✓ Br op tweede C
- ✓ Hele struktuur korrek

(2)

4.3.3

**Marking criteria**

- ✓ Functional group
- ✓ Whole structure correct

Merk kriteria

- ✓ Funksionele groep
- ✓ Hele struktuur korrek

(2)

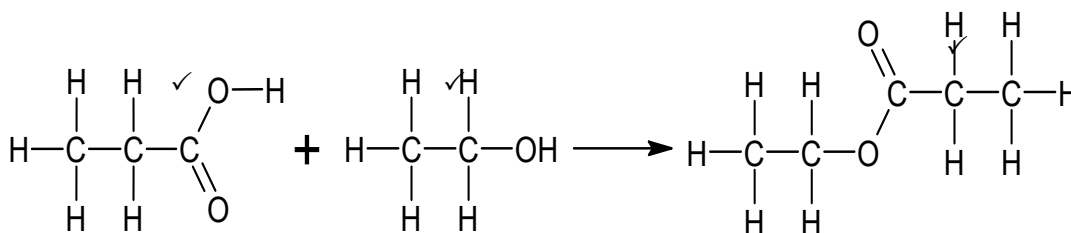
4.4

High temperature ✓ and high pressure. ✓ /

Hoë temperatuur ✓ en hoë druk ✓

(2)

4.5



Ethyl ✓ propanoate ✓

Etiel ✓ propanoat ✓

(5)

4.6

Esterification ✓

Esterifikasie ✓

(1)

[21]

QUESTION 5 / VRAAG 5

- 5.1 Reaction rate is the change in amount/concentration of reactants/products per unit time. ✓✓
Reaksiespoed is die verandering in hoeveelheid/konsentrasie van reaktante/produkte per tydseenheid. ✓✓ (2)
- 5.2 Controlled variable. ✓
Kontrole veranderlike ✓ (1)
- 5.3 Temperature. ✓
Temperatuur ✓ (1)
- 5.4 Graph A. ✓
The gradient of graph A is steeper than graph B.
At higher temperatures, the particles' kinetic energy is higher. ✓
More effective collisions occur per unit time. ✓
Grafiek A. ✓
Die gradiënt van grafiek A is steiler as grafiek B.
By hoër temperature is die deeltjies se kinetiese energie hoër. ✓
Meer effektiewe botsings vind per tydseenheid plaas. ✓ (3)
- 5.5 $n = \frac{V}{V_m}$ ✓
 $= \frac{200}{22.4}$ ✓
 $= 8.929 \text{ mol}$
 $\text{rate OF tempo} = \frac{n}{\Delta t}$ ✓
 $= \frac{8.929}{360}$ ✓
 $= 0,02 (\text{mol/dm}^3)$ ✓ (5)

[12]

QUESTION 6 / VRAAG 6

- 6.1.1 Dynamic equilibrium is a stage during a chemical reaction when the rate of the forward reaction is equal to the rate of the reverse reaction. ✓✓

Dinamiese ewewig is 'n stadium tydens 'n chemiese reaksie wanneer die tempo van die voorwaartse reaksie gelyk is aan die tempo van die terugwaartse reaksie. ✓✓

(2)

6.1.2

Marking Criteria

- Substitution of 0.5 and 2 into $n = \frac{m}{M}$
- Change in mol of N_2 and NH_3
- Using mol ratio 3 : 1 : 2
- Divide equilibrium mol by 2
- Correct K_c expression
- Substitution of 50 into the K_c expression
- Substitution of equilibrium concentrations into K_c expression
- Correct answer

Merk kriteria

- Vervanging van 0.5 en 2 in $n = \frac{m}{M}$
- Verandering in mol van N_2 en NH_3
- Gebruik molverhouding 3 : 1 : 2
- Deel ewewig mol deur 2
- Korrekte K_c -uitdrukking
- Vervanging van 50 in die K_c -uitdrukking
- Vervanging van ewewigskonsentrasies in K_c -uitdrukking
- Korrekte antwoord

$$\begin{aligned}
 n &= \frac{m}{M} \\
 &= \frac{0.5}{2} \checkmark \text{(a)} \\
 &= 0.25 \text{ mol}
 \end{aligned}$$

(8)

	3H ₂	N ₂	2NH ₃
Ratio / Verhouding	3	1	2
Initial / Aanvanklike	0.25	x	0
Change / Verandering	0.05 {	0.017	0.034 ✓(b) } ✓(c)
Equilibrium / Ewewig	0.20	x - 0.017	0.034
Concentration / Konsentrasie	0.10	$\frac{x - 0.017}{2}$	0.017 ✓(d)

$$K_c = \frac{[NH_3]^2}{[H_2]^3[N_2]} \quad \checkmark(e)$$

$$50 \checkmark(f) = \frac{(0.017)^2}{(0.1)^3 \left(\frac{x-0.017}{2}\right)} \quad \checkmark(g)$$

$$\frac{x - 0.017}{2} = 1.245 \times 10^{-5}$$

$$x = 0.017 \text{ mol} \quad \checkmark(h)$$

6.2.1 Temperature was increased. ✓

The forward reaction is endothermic. ✓

An increase in temperature favours the endothermic reaction. ✓

The forward reaction was favoured. ✓

Temperatuur is verhoog. ✓

Die voorwaartse reaksie is endotermies. ✓

'n Toename in temperatuur bevoordeel die endotermiese reaksie. ✓

Die voorwaartse reaksie is bevoordeel. ✓

(4)

6.2.2 GREATER THAN ✓

GROTER AS ✓

(1)

6.2.3 Pressure was decreased. ✓

Druk was verminder ✓

(1)

6.2.4 50 ✓

(1)

[17]

QUESTION 7 / VRAAG 7

7.1 Substance that releases hydronium ions (H_3O^+) in solution. ✓✓

Stof wat hidronium ione vrystel (H_3O^+) in oplossing ✓✓ (2)

7.2.1 H_2SO_4 and / en HSO_4^- ✓✓,

NH_4^+ and / en NH_3 ✓✓ (4)

7.2.2 Ampholyte is a substance that can act as either an acid or a base. ✓✓

Amfoliet is 'n stof wat as 'n suur of 'n basis kan optree ✓✓ (2)

7.2.3 HSO_4^- ✓ (1)

7.3.1 $[\text{H}_3\text{O}^+] = 2[\text{H}_2\text{SO}_4]$

$$= 2(0.2) \checkmark$$

$$= 0.4 \text{ mol.dm}^3$$

$$\text{pH} = -\log[\text{H}_3\text{O}^+] \checkmark$$

$$= -\log(0.4) \checkmark$$

$$0.398 \checkmark (4)$$

7.3.2 Sodium sulphate/ Na_2SO_4 ✓

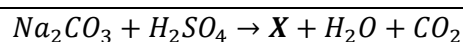
Natrium sulfaat (1)

7.3.3 **Marking criteria**

- Using the equation $c = \frac{n}{V}$
- Substitution of concentration and volume of H_2SO_4
- Substitution of concentration and volume of $\text{Mg}(\text{OH})_2$
- Number of moles of H_2SO_4 in excess.
- Subtraction of excess mole from the initial mole of H_2SO_4
- Substitution of 1060 into $m = n \times M$
- Substitution of $\frac{72}{100}$ OR 0.72 into $m = n \times M$
- Final answer

Merk kriteria

- Gebruik die vergelyking $c = n/V$
- Vervanging van konsentrasie en volume van H_2SO_4
- Vervanging van konsentrasie en volume van $Mg(OH)_2$
- Aantal mol H_2SO_4 in oormaat.
- Aftrekking van oortollige mol van die aanvanklike mol H_2SO_4
- Vervanging van 1060 in $m = n \times M$
- Vervanging van $\frac{72}{100}$ OF 0.72 in $m = n \times M$
- Finale antwoord



$$n_{H_2SO_4} = cV \checkmark \textbf{(a)}$$

$$= (0.01)(0.02) \checkmark \textbf{(b)}$$

$$= 0.002 \text{ mol}$$

$$n(Mg(OH)_2) = (0.025)(0.1) \checkmark \textbf{(c)}$$

$$= 0.0025 \text{ mol}$$

$$n(MgSO_4) = n(H_2SO_4)$$

$$n(H_2SO_4) \text{ in excess OF in oormaat} = 0.0025 \text{ mol} \checkmark \textbf{(d)}$$

$$n(H_2SO_4) \text{ reacted with OF reageer met } Na_2CO_3 = 0.02 - 0.0025 \checkmark \textbf{(e)}$$

$$= 0.0175 \text{ mol}$$

$$n(H_2SO_4) = n(Na_2CO_3)$$

$$n(Na_2CO_3) = 0.0175 \text{ mol}$$

$$m(Na_2CO_3) = (0.0175)(1060) \checkmark \textbf{(f)} \frac{72}{100} \checkmark \textbf{(g)}$$

$$= 1.335 \text{ g} \checkmark \textbf{(h)}$$

(8)

[22]

QUESTION 8 / VRAAG 8

8.1 Cell that converts chemical energy to electrical energy. ✓✓
 Sel wat chemiese energie omskakel na elektriese energie ✓✓ (2)

8.2 Concentration of 1 mol/dm³ ✓
 Temperature of 25°C ✓
 Konsentrasie van 1 mol/dm³ ✓
 Temperatuur van 25°C ✓ (2)

8.3 To complete the circuit/To maintain cell neutrality ✓
 Om die stroombaan te voltooi/Om selsneutraliteit te handhaaf ✓ (1)

8.4 **Note:**

- Accept any other correct formula from the data sheet.
- Any other formula using unconventional abbreviations, e.g.
 $E_{\text{cell}} = E_{\text{OA}} - E_{\text{RA}}$ Max 4/5
- Followed by correct substitutions

Nota:

- Aanvaar enige ander korrekte formule uit die datablad.
- Enige ander formule wat onkonvensionele afkortings gebruik, bv. $E_{\text{sel}} = E_{\text{OM}} - E_{\text{RM}}$ Maks 4/5
- Gevolg deur korrekte substitusies

$E^{\theta}_{\text{cell}} = E^{\theta}_{\text{cathode}} - E^{\theta}_{\text{anode}} \checkmark$	OF	$E^{\theta}_{\text{sel}} = E^{\theta}_{\text{kathode}} - E^{\theta}_{\text{anode}} \checkmark$
$2.51 \checkmark = E^{\theta}_{\text{cathode}} - (-2.36) \checkmark$	OF	$2.51 \checkmark = E^{\theta}_{\text{cathode}} - (-2.36) \checkmark$
$E^{\theta}_{\text{cathode}} = 2.51 - 2.36$	OF	$E^{\theta}_{\text{kathode}} = 2.51 - 2.36$
$= 0.15V \checkmark$		

M is tin/Sn ✓ (5)

- 8.5 Decrease.✓
In this cell, Mg is the anode.✓
Oxidation occurs on the Mg electrode.✓
Verlaag✓
In die sel, is Mg die anode✓
Oksidasie vind plaas op die Mg elektrode✓ (3)
- 8.6 Yes.✓
The reaction does not need energy to take place.✓
Ja✓
Die reaksie het nie energie nodig om te kan plaasvind nie✓ (2)

[15]

QUESTION 9 / VRAAG 9

- 9.1 Electrical energy to chemical energy.✓
Elektriese energie na chemiese energie✓ (1)
- 9.2 NiCl_2 ✓ (1)
- 9.3 Anode.✓ (1)
- 9.4 $\text{Ni}^{2+} + 2\text{e}^- \rightarrow \text{Ni}$ ✓✓ (2)

9.5

Marking criteria

- Substitution of 2000 and 1.6×10^{-19} into the $n = \frac{Q}{e}$
- Dividing by Avogadro's constant
- Mole ratio 1 : 2
- Using Molar mass of Fe of 56g.mol^{-1}
- Addition of mass of spoon and mass of Nickel
- Final answer

Merk kriteria

- Vervanging van 2000 en 1.6×10^{-19} in die $n = Q/e$
- Deling deur Avogadro se konstante
- Molverhouding 1 : 2
- Gebruik molêre massa van Fe van 56 g.mol^{-1}
- Optelling van massa van lepel en massa van nikkel
- Finale antwoord

$$n = \frac{Q}{e}$$

$$= \frac{2000}{1.6 \times 10^{-19}} \checkmark \textbf{(a)}$$

1.25×10^{22} electrons OF elektrone

(6)

$$n = \frac{N}{N_A}$$

$$= \frac{1.25 \times 10^{22}}{6.02 \times 10^{23}} \checkmark \text{(b)}$$

$$= 2.0764 \times 10^{-2} \text{mol}$$

$$n(\text{Ni}) = \frac{2.0764 \times 10^{-2}}{2} \checkmark \text{(c)}$$

$$= 1.0382 \times 10^{-2} \text{mol}$$

$$n = \frac{m}{M}$$

$$1.0382 \times 10^{-2} = \frac{m}{59} \checkmark \text{(d)}$$

$$m = 0.613 \text{g}$$

$$\text{total mass OF totale massa} = 15 + 0.613 \checkmark \text{(e)}$$

$$= 15.613 \text{g} \checkmark \text{(f)}$$

[11]**TOTAL: 150**