



**NATIONAL  
SENIOR CERTIFICATE/  
NASIONALE  
SENIOR SERTIFIKAAT**

**GRADE/GRAAD 11**

**NOVEMBER 2020**

**PHYSICAL SCIENCES P2/  
FISIESE WETENSKAPPE V2  
MARKING GUIDELINE/NASIENRIGLYN  
(EXEMPLAR/EKSEMPLAAR)**

**MARKS/PUNTE: 150**

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This marking guideline consists of 12 pages./  
*Hierdie nasienriglyn bestaan uit 12 bladsye.*

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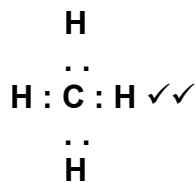
**QUESTION 1/VRAAG 1**

- 1.1 A ✓✓ (2)  
 1.2 C ✓✓ (2)  
 1.3 D ✓✓ (2)  
 1.4 C ✓✓ (2)  
 1.5 A ✓✓ (2)  
 1.6 B ✓✓ (2)  
 1.7 A ✓✓ (2)  
 1.8 A ✓✓ (2)  
 1.9 D ✓✓ (2)  
 1.10 B ✓✓ (2)
- [20]**

**QUESTION 2/VRAAG 2**

- 2.1 The sharing of electrons between two atoms to form a molecule. ✓✓ /  
 Die deel van elektrone tussen twee atome om 'n molekule te vorm. (2)

2.2



(2)

- 2.3 2.3.1 C – H. ✓ O-atom has a smaller atomic radius than the C-atom. ✓  
 O-atom het 'n 2 kleiner atomiese radius as die C-atom.

**OR/ OF**

C-atom has a larger atomic radius than the O-atom.  
 C-atom het 'n groter atomiese radius as die O-atom. (2)

- 2.3.2 O - H ✓ (1)

- 2.4 Two / Twee ✓ **OR/OF** 2 (1)

- 2.5  $\text{NH}_4^+$  ✓ (1)

- 2.6 N-atom is more electronegative than the H-atom. ✓  
The  $\text{NH}_3$  molecular geometry/charge distribution is asymmetrical ✓ / The electron density (charges) will be distributed unevenly around the molecule.

*N-atoom is meer elektron-negatief as die H-atoom*

*Die  $\text{NH}_3$  se molekulêre geometrie/lading is asimmetries versprei /*

*Die elektrondigtheid (lading) sal oneweredig rondom die molekule versprei wees.*

C-atom is more electronegative than the H-atom ✓ but  $\text{CH}_4$  molecular geometry / charge distribution is symmetrical ✓

*C-atoom is meer elektron-negatief as die H-atoom maar die  $\text{CH}_4$  molekulêre geometrie/lading verspreiding is simmetries.*

(4)  
[13]

**QUESTION 3/VRAAG 3**

- 3.1 3.1.1 The temperature at which the vapour pressure of a liquid equals atmospheric pressure. ✓✓  
*Die temperatuur waarteen die dampdruk van 'n vloeistof gelyk aan die atmosferiese druk is.* (2)
- 3.1.2 Gas ✓ (1)
- 3.1.3 Dipole-dipole ✓ (forces) / *Dipool-dipool (kragte)* (1)
- 3.1.4 **B** ✓  
Compound **B** has larger molecular size ✓✓ / Compound **A** has a smaller molecular size  
*Verbinding B het 'n groter molekulêre grootte / Verbinding A het 'n kleiner molekulêre grootte.* (3)
- 3.1.5 **A** ✓  
Lower boiling point / ✓ *Laer kookpunt*

**OR/OF**

B has a higher boiling point / B het 'n hoër kookpunt (2)

- 3.1.6 Compound C/ HF has hydrogen bonds. ✓  
HCl (A) and HBr (B) have dipole-dipole forces.

The hydrogen bonds / intermolecular forces in compound C / HF is stronger ✓ than the dipole-dipole forces / intermolecular forces in HCl (A) and HBr (B).

Therefore more energy will be required to overcome the intermolecular forces in HF (A). ✓

Verbinding C/HF het waterstofbindings.  
HCl (A) en HBr (B) het dipool-dipoolkragte.

Die waterstofbinding/intermolekulêre kragte in verbinding C / HF is sterker as die die dipool-dipoolkragte/intermolekulêre kragte in HCl (A) en HBr (B).

Daarom word meer energie benodig om die intermolekulêre kragte in HF (A te oorkom).

#### OR/OF

Compound C / HF has hydrogen bonds. ✓  
HCl (A) and HBr (B) have dipole-dipole forces.

The dipole-dipole forces / intermolecular forces in compounds HCl (A) and HBr (B) is weaker ✓ than the intermolecular forces in HF (C)

Therefore less energy will be required to overcome the intermolecular forces in HCl (A) and HBr (B). ✓

Verbinding C / HF het waterstofbindings  
HCl (A) en HBr (B) het dipool-dipoolkragte

Die dipool-dipool/intermolekulêre kragte in verbindings HCl (A) en HBr (B) is swakker as die waterstofbinding/intermolekulêre kragte in HF (C).

Daarom word minder energie benodig om die intermolekulêre kragte in HCl (A) en HBr (B) te oorkom.

- 3.2 3.2.1 CCl<sub>4</sub> ✓ (1)

- 3.2.2 CCl<sub>4</sub> and I<sub>2</sub> have London forces only. ✓  
H<sub>2</sub>O has (London forces) and hydrogen bonds ✓  
Intermolecular forces in solution are of comparable magnitude (CCl<sub>4</sub>). ✓

**OR** IMF in solution are not of comparable magnitude (H<sub>2</sub>O)

CCl<sub>4</sub> en I<sub>2</sub> het slegs Londenkragte

H<sub>2</sub>O het (londenkragte) en waterstofbindings **OF**

Intermolekulêre kragte in oplossing is van vergelykbare grootte.

(3)  
**[16]**

**QUESTION 4/VRAAG 4**

4.1 Charles' law ✓ / *Charles se wet* (1)

4.2 4.2.1 What effect will a change in temperature have on the volume of the gas? ✓✓/  
 What is the relationship between temperature and volume of gas?

*Watter effek sal die verandering in temperatuur op die volume van die gas hê?*

*Wat is die verhouding tussen temperatuur en volume van die gas?*

**Marking guideline/Nasienriglyn**

- Correct independent and dependent variable
- *Korrekte onafhanklike en afhanklike veranderlike*
- In the form of a question
- *In die vorm van 'n vraag*

(2)

4.2.2 Pressure OR the amount of gas.  
*Druk OF hoeveelheid gas*  
 Any one/Enige een ✓

(1)

4.3 Thermometer/ *Termometer* ✓

(1)

4.4 4.4.1  $\frac{T_1}{V_1} = \frac{T_2}{V_2}$  ✓

$$\frac{269}{66} \checkmark = \frac{T_2}{67} \checkmark$$

$$T_2 = 273,08 \text{ K}$$

$$R = 273,08 \checkmark \text{ (K)}$$

(4)

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

$$n = \frac{132}{44} \checkmark$$

$$n = 3 \text{ mol}$$

$$pV = nRT \checkmark$$

$$p(66 \times 10^{-3}) \checkmark = (3)(8,31)(269) \checkmark$$

$$p = 101\,608,64 \text{ Pa} \checkmark$$

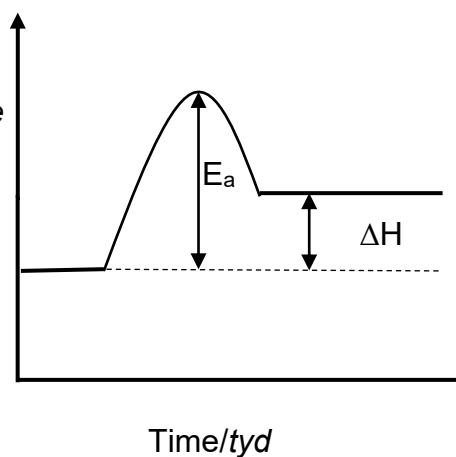
(5)

- 4.5 Low temperature ✓ and high pressure ✓ / *Lae temperatuur en hoë druk* (2)
- 4.6 H<sub>2</sub> ✓  
H<sub>2</sub> has smaller molecules ✓ and weaker intermolecular forces ✓ /  
*H<sub>2</sub> het kleiner molekules en swakker intermolekulêrekrage.* (3)

**[19]****QUESTION 5/VRAAG 5**

- 5.1 The minimum energy needed for a reaction to take place. ✓✓ /  
*Die minimum energie wat benodig word vir 'n reaksie om plaas te vind.* (2)
- 5.2 Reaction / *Reaksie I.* ✓  
The temperature of the reaction mixture increases. ✓  
*Die temperatuur van die reaksiemengsel verhoog.* (2)
- 5.3 NEGATIVE / *NEGATIEF* ✓ (1)
- 5.4 Catalyst / *Katalisator* ✓ (1)
- 5.5 LARGER THAN / *GROTER AS* ✓✓ (2)

- 5.6 Potential energy (kJ·mol<sup>-1</sup>) / *Potensiële energie (kJ·mol<sup>-1</sup>)*

**Marking criteria / Nasienkriteria**

Correct shape ✓  
*Korrekte vorm*

ΔH correctly indicated ✓  
*ΔH korrek aangedui*

E<sub>a</sub> correctly indicated ✓  
*E<sub>a</sub> korrek aangedui*

**(3)**  
**[11]**

**QUESTION 6/VRAAG 6**

6.1 6.1.1 The simplest whole number ratio of elements in a given compound ✓✓ /  
*Die eenvoudigste heelgetalverhouding van elemente in 'n gegewe verbinding* (2)

$$6.1.2 \quad n(\text{C}) = \frac{m}{M} \checkmark$$

$$n(\text{C}) = \frac{54,55}{12} \checkmark = 4,55 \text{ mol}$$

$$n(\text{H}) = \frac{9,09}{1} \checkmark = 9,09 \text{ mol}$$

$$n(\text{O}) = \frac{36,36}{16} \checkmark = 2,27 \text{ mol}$$

$$n(\text{C}) : n(\text{H}) : n(\text{O})$$

$$\frac{4,55}{2,27} : \frac{9,09}{2,27} : \frac{2,27}{2,27} \checkmark$$

$$2 : 4 : 1$$

Empirical formula / *Empiriese formule*:  $\text{C}_2\text{H}_4\text{O}_1 \checkmark$  (6)

$$6.1.3 \quad \text{Ratio / Verhouding} = \frac{\text{molar mass / molêre massa}}{\text{formula mass / formule massa}}$$

$$\text{Ratio / verhouding} = \frac{88}{44} \checkmark$$

$$\text{Ratio / verhouding} = 2$$

Molecular formula / *Molekulêre formule*:  $\text{C}_4\text{H}_8\text{O}_2 \checkmark$  (2)

6.2 6.2.1 The amount of solute per litre/volume of solution ✓✓ /  
*Die hoeveelheid opgeloste stof per liter/volume van oplossing* (2)

$$6.2.2 \quad c = \frac{m}{MV} \checkmark$$

$$c = \frac{8}{(40)\checkmark(0,25)} \checkmark$$

$$c = 0,8 \text{ mol} \cdot \text{dm}^{-3} \checkmark$$

$$n = m/M$$

$$= 8/40 \checkmark$$

$$= 0,2 \text{ mol}$$

$$c = n/V$$

$$= 0,2/0,25 \checkmark$$

$$= 0,8 \text{ mol} \cdot \text{dm}^{-3} \checkmark$$

for both formulae/  
vir beide formules

Marking guide / Nasienriglyn

- Formula / Formule ✓ ✓
- Substitution of / substitusie van 8 and / en 0,25 or/ of 0,2 and 0,25
- Substitution of / substitusie van 40/
- Final answer / Finale antwoord ✓

(4)

6.3  $\text{NaN}_3$

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

$$n = \frac{55}{65} \checkmark$$

$$n = 0,85 \text{ mol}$$

Mole ratio / molverhouding:  $\text{NaN}_3 : \text{N}_2$

2 : 3

$$n(\text{N}_2) = 0,85 \times \frac{3}{2} \checkmark$$

$$n(\text{N}_2) = 1,275 \text{ mol}$$

$$V = nV_m$$

$$V = (1,275)(22,4) \checkmark$$

$$V = 28,56 \text{ dm}^3 \checkmark$$

Any one / Enige een ✓

(5)

[21]

## QUESTION 7/VRAAG 7

7.1 The substance that is completely used-up in a chemical reaction. ✓✓ /  
Die stof wat volledig in 'n chemiese reaksie opgebruik word.

(2)

7.2

$H_2SO_4$ $n = \frac{m}{M} \checkmark$ $n = \frac{2000}{98} \checkmark$ $n = 20,41 \text{ mol}$	
Mole ratio / mol verhouding = $\frac{H_2SO_4}{NH_3}$ Mole ratio / mol verhouding = $\frac{1}{2} = 0,5 \checkmark$ Mole ratio / mol verhouding = $\frac{20,41}{58,82} \checkmark = 0,34$ Ratio smaller than / Verhouding kleiner as 0,5.	<b>OR / OF</b> Mole ratio / mol verhouding = $\frac{NH_3}{H_2SO_4}$ Mole ratio / mol verhouding = $\frac{2}{1} = 2$ Mole ratio / mol verhouding = $\frac{58,82}{20,41} = 2,88$ Ratio greater than / Verhouding groter as 2.
$H_2SO_4$ is the limiting reagent / $H_2SO_4$ is die beperkende reagens.	

$$n [(NH_4)_2SO_4] = 20,41 \times \frac{1}{1} = 20,41 \checkmark$$

$$m = nM$$

$$m = (20,21)(132) \checkmark$$

$$m = 2\,667,72 \text{ g} \checkmark$$

(7)  
[9]

**QUESTION 8/VRAAG 8**

8.1 8.1.1 A base is a proton/ $H^+$  ion acceptor. ✓✓ /  
*'n Basis is 'n protoon/ $H^+$  ioon-aanvaarder* (2)

8.1.2  $HPO_4^{2-}$  and/en  $PO_4^{3-}$  ✓ **OR/OF**  $H_3O^+$  and/en  $H_2O$  (1)

8.1.3 ACIDIC / SUUR. ✓  
(Excess)/ (Oormaat)  $H_3O^+$  ✓ are produced / word geproduseer. (2)

8.1.4  $HPO_4^{2-}$  ✓✓ (2)

8.2  $CuO + 2HNO_3 \checkmark \longrightarrow Cu(NO_3)_2 + H_2O \checkmark$  ✓Balancing / *Balansering*

**Marking guide/ Nasienriglyn**

- Reactants / *Reaktante*
- Products / *Produkte*
- Balancing / *Balansering*

(3)

8.3 8.3.1

**Marking guide / Nasienriglyn**

- Formula / *Formule*  $n = cV$
- Substitution into / *Substitusie in*  $n = cV$
- Ratio / *Verhouding*  $CaCO_3 : H_2SO_4 : CO_2 : H_2SO_4$
- Formula / *Formule*  $n = m/M$
- Substitution / *Substitusie* of 100 into  $n = m/M$
- Calculation of / *Berekening van* % Purity / *Suiwerheid*
- Final answer / *Finale antwoord*

$n_{acid}$  reacting / *suur wat reageer het* =  $cV$  ✓

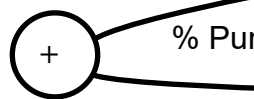
=  $1,5 \times 200/1000$  ✓

= 3 mol

$M(CaCO_3)$  used / *gebruik* =  $nM$  ✓

=  $3 \times 100$  ✓

= 30 g

 % Purity/ *Suiwerheid* =  $m_{pure}/suiwer/m_{impure}/onsuiwer \times 100$

=  $30/40 \times 100$  ✓

= 75% ✓

(6)

8.3.2  $c_1V_1 = c_2V_2$

$9 \times 10$  ✓ =  $1,5 \checkmark V$

$60 \text{ cm}^3 = V_{\text{solution / oplossing}}$

$V_{\text{water}} = 60 - 10$  ✓

=  $50 \text{ cm}^3$  ✓

(4)

**[20]**

**QUESTION 9/VRAAG 9**

9.1 9.1.1 Loss of electrons ✓✓ / *Verlies van elektrone* (2)

9.1.2 Zn ✓✓ (2)

9.1.3  $\text{Fe}^{3+} + \text{e}^- \rightarrow \text{Fe}^{2+}$  ✓✓ (2)

9.2 9.2.1 + 5 ✓✓ (2)

9.2.2  $\text{Ag (s)} \rightarrow \text{Ag}^+ \text{ (aq)} + \text{e}^-$  ✓

$\text{NO}_3^- \text{ (aq)} + 2 \text{H}^+ + \text{e}^- \rightarrow \text{NO}_2 \text{ (g)} + \text{H}_2\text{O}$  ✓

$\text{Ag (s)} + \text{NO}_3^- \text{ (aq)} + 2 \text{H}^+ \rightarrow \text{Ag}^+ \text{ (aq)} + \text{NO}_2 \text{ (g)} + \text{H}_2\text{O}$  ✓✓

**Marking guideline/ Nasienriglyn**

Correct oxidation half reaction / *Korrekte oksidasie halfreaksie*

Correct reduction half reaction / *Korrekte reduksie halfreaksie*

Final reaction correct / *Finale reaksie korrek*

Balanced / *Gebalanseerd*

(4)  
[12]

**QUESTION 10/VRAAG 10**

10.1 10.1.1 Witwatersrand ✓ (1)

10.1.2 Reduced ✓ / *Gereduseer/verminder*

Oxidation number (of Au) decreases ✓✓ (from +1 to 0) /  
Oksidasiegetal (van Au) verlaag (vanaf +1 tot 0) (3)

10.1.3 NaCN is harmful as it is poisonous to humans ✓✓ /  
*NaCN is skadelik omdat dit giftig is vir mense* (2)

10.1.4 Smelting ✓ (1)

10.2 10.2.1 Release of greenhouse gas /  $\text{CO}_2$  / Global warming ✓  
Air pollutions/toxins released into air. ✓

*Vrystelling van kweekhuisgas /  $\text{CO}_2$  / Aardverwarming /  
Lugbesoedeling / gifstowwe wat in die lug vrygestel word.* (2)  
[9]

**TOTAL/TOTAAL: 150**