



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE/
NASIONALE
SENIOR SERTIFIKAAAT**

GRADE/GRAAD 11

**PHYSICAL SCIENCES: CHEMISTRY (P2)
FISIESE WETENSKAPPE: CHEMIE (V2)**

NOVEMBER 2019

MARKING GUIDELINES/NASIENRIGLYNE

MARKS/PUNTE: 150

**These marking guidelines consist of 14 pages./
Hierdie nasienriglyne bestaan uit 14 bladsye.**

QUESTION 1/VRAAG 1

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

QUESTION 2/VRAAG 2

2.1

2.1.1

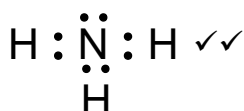
Marking guidelines/Nasienriglyne

If any of the underlined key words/phrases are omitted: minus 1 mark
Indien enige van die onderstreepte sleutelwoorde/frases uitgelaat is: minus 1 punt

Two electrons shared between two atoms in a covalent bond. ✓✓
Twee elektrone gedeel tussen twee atome in 'n kovalente binding. (2)

2.1.2

(a)

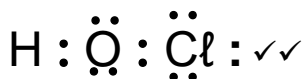


Marking guidelines/Nasienriglyne

- Whole structure correct./Hele struktuur korrek. ✓✓
- $\text{H} : \ddot{\text{N}} : \text{H}$ ✓ Max./Maks. $\frac{1}{2}$
H

(2)

(b)



Marking guidelines/Nasienriglyne

- Whole structure correct./Hele struktuur korrek. ✓✓
- $\text{H} : \text{Cl} : \text{O}$ Max./Maks. $\frac{1}{2}$

(2)

2.1.3

(a)

3 ✓

(1)

(b)

2 ✓

(1)

(c)

Trigonal pyramidal ✓
Trigonaal piramidaal

(1)

2.1.4

O-H ✓

O-H $\Delta\text{EN} = 3,5 - 2,1 = 1,4$
N-H $\Delta\text{EN} = 3 - 2,1 = 0,9$ } ✓

OR/OF

ΔEN between H and O is greater./ ΔEN between N and H is smaller.
 ΔEN tussen H en O is groter./ ΔEN tussen N en H is kleiner. (2)

2.1.5

Hydrogen bonds ✓
Waterstofbindings

(1)

2.1.6

Dative covalent bond ✓
Datief kovalente binding

(1)

2.2

2.2.1

Marking guidelines/Nasienriglyne

If any of the underlined key words/phrases are omitted: minus 1 mark
*Indien enige van die onderstreepte sleutelwoorde/frases uitgelaat is:
minus 1 punt*

Energy needed to break one mole of a compound's molecules into separate atoms. ✓✓

Die energie benodig om een mol molekule van 'n verbinding in aparte atome op te breek.

(2)

2.2.2

A ✓

When the bond order increases/double bond is formed, the bond length decreases ✓ and the bond energy increases. ✓

Wanneer die bindingsorde verhoog/dubbelbinding gevorm word, verlaag die bindingslengte en verhoog die bindingsenergie.

OR/OF

When a second bond is formed, the bond length decreases ✓ and the potential energy of the molecule decreases. ✓

Wanneer die tweede binding gevorm word, verlaag die bindingslengte en verlaag die potensiële energie.

(3)

2.2.3

148 pm ✓

(1)

[19]

QUESTION 3/VRAAG 3

3.1

Marking guidelines/Nasienriglyne

If any of the underlined key words/phrases are omitted: minus 1 mark
*Indien enige van die onderstreepte sleutelwoorde/frases uitgelaat is:
minus 1 punt*

Temperature at which the solid and liquid phases of a substance are at equilibrium. ✓✓

Die temperatuur waarby die vaste- en vloeistoffases van 'n stof in ewewig is. (2)

3.2

- HF has hydrogen bonds between molecules. ✓
- HCl has dipole-dipole forces. ✓
- Hydrogen bonds are stronger than dipole-dipole forces. */Intermolecular forces in HF stronger. / Intermolecular forces in HCl weaker.* ✓
- More energy is needed to overcome/break intermolecular forces. ✓
- *HF het waterstofbindings tussen molekule.*
- *HCl het dipool-dipoolkragte.*
- *Waterstofbindings is sterker as dipool-dipoolkragte. / Intermolekulêre kragte in HF sterker. / Intermolekulêre kragte in HCl swakker.*
- *Meer energie benodig om intermolekulêre kragte te oorkom/breek.* (4)

3.3

CS₂ ✓ (1)

3.4

- CS₂ has a greater surface area/molecular mass/larger molecules (than CO₂). ✓
- London forces increase with molecular mass/molecular size. ✓
- More energy needed to break/overcome intermolecular forces. ✓
- *CS₂ has a groter oppervlak/molekulêre massa/groter molekule (as CO₂).*
- *Londonkragte neem toe met molekulêre massa/molekulêre grootte.*
- *Meer energie benodig om intermolekulêre kragte te oorkom/breek.* (3)

3.5

HCl ✓
Lowest boiling point. ✓
Laagste kookpunt. (2)

[12]

QUESTION 4/VRAAG 4

4.1

Marking guidelines/Nasienglyne

If any of the underlined key words/phrases are omitted: minus 1 mark
 Indien enige van die onderstreepte sleutelwoorde/frases uitgelaat is:
 minus 1 punt

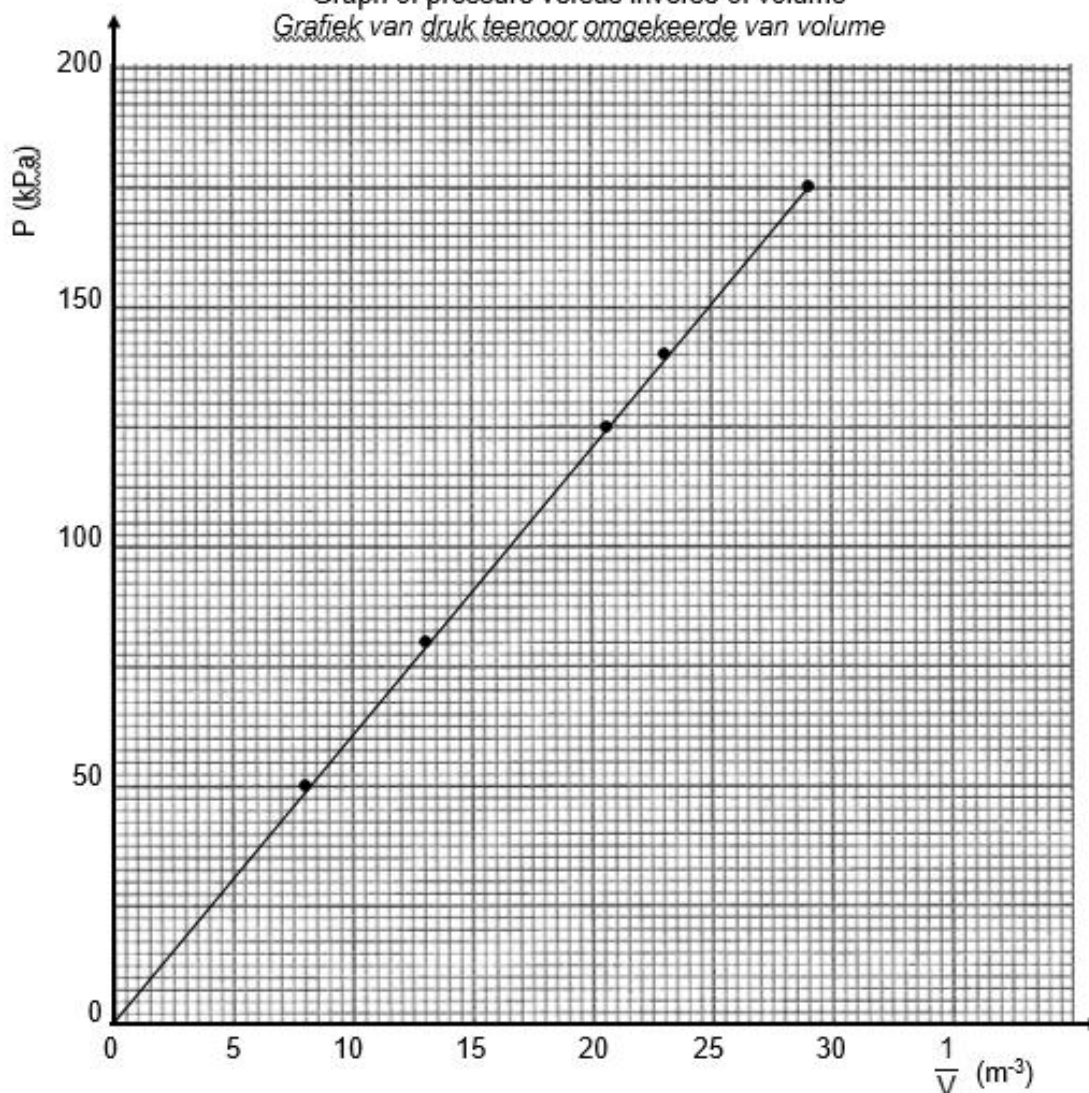
Pressure of an enclosed gas is inversely proportional to the volume it occupies at constant temperature. ✓✓

Die druk van 'n ingeslote gas is omgekeerd eweredig aan die volume wat dit beslaan by konstante temperatuur.

(2)

4.2

Graph of pressure versus inverse of volume
 Grafiek van druk teenoor omgekeerde van volume



Marking criteria for graph/Nasienglyne vir grafiek

Three (3) points plotted correctly./Drie (3) punte korrek gestip.	✓
All 5 points correctly plotted./Al 5 punte korrek gestip.	✓✓
Line of best fit drawn./Beste paslyn getrek.	✓

Refer to the last page of marking guideline for graph drawn on supplied graph sheet./Verwys na die laaste bladsy van nasienglyne vir grafiek getrek op verskafde grafiekpapier.

(3)

4.3 Temperature/ *Temperatuur* ✓

OR/OF

Number of moles of gas/ *Aantal mol gas*

Gradient/ *gradiënt* = $pV = nRT$ ✓

(2)

4.4 Particles/molecules of real gases occupy volume. ✓

At high pressure, volume of gas molecules/particles become significant ✓ and the measured volume is greater than expected. ✓

Deeltjies/molekule van werklike gasse beslaan volume.

By hoë druk word volume van molekule/deeltjies beduidend en die gemete volume is groter as verwag.

(3)

4.5 $pV = nRT$ ✓

$(125\ 000)(0,049)$ ✓ = $n(8,31)(298)$ ✓

$n = 2,47$ mol ✓

(4)

[14]

QUESTION 5/VRAAG 5

5.1

$\frac{p_1}{T_1} = \frac{p_2}{T_2}$

$\frac{240}{303}$ ✓ = $\frac{x}{263}$ ✓

$x = 208,32$ (kPa) ✓

(3)

5.2 Greater than/ *Groter as* ✓

(1)

5.3

Marking guidelines/Nasienriglyne

• Compare gradients./ *Vergelyk gradiënte.* ✓

• Gradient = $\frac{p}{T} = \frac{nR}{V}$. ✓

• Compare $\frac{1}{V}$ ✓

OPTION 1/OPSIE 1

Gradient of graph for N smaller than gradient of graph for M./ *Gradiënt van grafiek vir N kleiner as gradiënt van grafiek vir M.* ✓

Gradient = $\frac{nR}{V}$ ✓

Therefore/ *Dus* $(\frac{1}{V})_N < (\frac{1}{V})_M$ ✓

Thus volume of N larger than volume of M.
Dus is die volume van N groter as die volume van M.

OPTION 2/OPSIE 2

Gradient (N) < gradient (M) ✓

$(\frac{p}{T})_N < (\frac{p}{T})_M$

$(\frac{nR}{V})_N < (\frac{nR}{V})_M$ ✓

$(\frac{1}{V})_N < (\frac{1}{V})_M$ ✓

$V_N > V_M$

(3)

[7]

QUESTION 6/VRAAG 6

6.1

6.1.1

Marking guidelines/Nasienriglyne

If any of the underlined key words/phrases are omitted: minus 1 mark
Indien enige van die onderstreepte sleutelwoorde/frases uitgelaat is: minus 1 punt

The mass of one mole of a substance measured in $\text{g}\cdot\text{mol}^{-1}$. ✓✓
Die massa van een mol van 'n stof gemeet in $\text{g}\cdot\text{mol}^{-1}$.

(2)

6.1.2

$$n(\text{C}) = \frac{39,13}{12} \checkmark = 3,26$$

$$n(\text{H}) = \frac{8,7}{1} \checkmark = 8,7$$

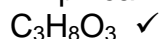
$$n(\text{O}) = \frac{52,17}{16} \checkmark = 3,26$$

Ratio/Verhouding C : H : O:

$$\left. \begin{array}{l} \frac{3,26}{3,26} = 1 \\ \frac{8,7}{3,26} = 2,67 \\ \frac{3,26}{3,26} = 1 \end{array} \right\} \checkmark$$

$$\text{C} : \text{H} : \text{O} = 1 : 2,67 : 1 = 3 : 8 : 3 \checkmark$$

Empirical formula/*Empiriese formule*:



Marking guidelines/Nasienriglyne

- Divide %C by 12 $\text{g}\cdot\text{mol}^{-1}$./Deel %C deur 12 $\text{g}\cdot\text{mol}^{-1}$.
- Divide %H by 1 $\text{g}\cdot\text{mol}^{-1}$./Deel %H deur 1 $\text{g}\cdot\text{mol}^{-1}$.
- Divide %O by 16 $\text{g}\cdot\text{mol}^{-1}$./Deel %O deur 16 $\text{g}\cdot\text{mol}^{-1}$.
- Divide by smallest answer/Deel deur kleinste antwoord.
- Ratio/Verhouding: 3 : 8 : 3
- Final answer/Finale antwoord: $\text{C}_3\text{H}_8\text{O}_3 \checkmark$

(6)

6.1.3

5 ✓

(1)

6.1.4

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

$$n = \frac{18}{137} \checkmark$$

$$n = 0,131 \text{ mol}$$

$$\text{KMnO}_4 : \text{Mn}_2\text{O}_3 = 2 : 1$$

$$n(\text{Mn}_2\text{O}_3) = 0,0656 \text{ mol} \checkmark$$

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

$$0,0656 = \frac{m}{158} \checkmark$$

$$\therefore m = 10,38 \text{ g} \checkmark$$

Marking guidelines/Nasienriglyne

- Substitute 137 $\text{g}\cdot\text{mol}^{-1}$ in ratio/ $n = \frac{m}{M}$. ✓
Vervang 137 $\text{g}\cdot\text{mol}^{-1}$ in verhouding/ $n = \frac{m}{M}$.
- Use ratio/*Gebruik verhouding*:
 $n(\text{Mn}_2\text{O}_3) = \frac{1}{2}n(\text{KMnO}_4) \checkmark$
- Substitute 158 $\text{g}\cdot\text{mol}^{-1}$ in ratio/ $n = \frac{m}{M}$. ✓
Vervang 158 $\text{g}\cdot\text{mol}^{-1}$ in verhouding/ $n = \frac{m}{M}$.
- Final answer/Finale antwoord: 10,38 g ✓

(4)

6.2

6.2.1

Marking guidelines/Nasienriglyne

If any of the underlined key words/phrases are omitted: minus 1 mark
Indien enige van die onderstreepte sleutelwoorde/frases uitgelaat is: minus 1 punt

The amount of solute/dissolved substance per litre/dm³ of solution. ✓✓
 The hoeveelheid opgeloste stof per liter/dm³ van die oplossing.

(2)

6.2.2

$$c = \frac{n}{V} \checkmark$$

$$0,1 = \frac{n}{0,1} \checkmark$$

$$n = 0,01 \text{ mol} \checkmark$$

(3)

6.2.3

$$\begin{aligned} n(\text{HCl}) &= \frac{V}{V_m} \checkmark \\ &= \frac{0,460}{24,45} \checkmark \\ &= 0,01881 \text{ mol} \end{aligned}$$

Ratio HCl : NaCl = 1 : 1

$$n(\text{NaCl}) = 0,01881 \text{ mol} \checkmark$$

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

$$0,0188 = \frac{m}{58,5} \checkmark$$

$$m(\text{NaCl}) = 1,1 \text{ g}$$

$$\begin{aligned} \% \text{purity} &= \frac{1,1}{1,5} \times 100 \checkmark \\ &= 73,37\% \checkmark \end{aligned}$$

Marking guidelines/Nasienriglyne

- Formula/Formule: $n = \frac{m}{M} / n = \frac{V}{V_m} \checkmark$
- Substitute 25,45 dm³·mol⁻¹ in ratio/ $n = \frac{V}{V_m} \checkmark$
 Vervang 25,45 dm³·mol⁻¹ in verhouding/
 $n = \frac{V}{V_m} \checkmark$
- Use ratio/Gebruik verhouding:
 $n(\text{NaCl}) = n(\text{HCl}) \checkmark$
- Substitute 58,5 g·mol⁻¹ in ratio/ $n = \frac{m}{M} \checkmark$
 Vervang 58,5 g·mol⁻¹ in verhouding/ $n = \frac{m}{M} \checkmark$
- $\frac{m(\text{calculated} / \text{bereken})}{m(\text{impure} / \text{onsuiwer})} \times 100 \checkmark$
- Final answer/Finale antwoord: 73 g ✓

(6)
 [24]

QUESTION 7/VRAAG 7

7.1

Marking guidelines/Nasienriglyne

If any of the underlined key words/phrases are omitted: minus 1 mark
Indien enige van die sleutelwoorde/frases uitgelaat is: minus 1 punt

The energy absorbed or released per mole in a chemical reaction. ✓✓
Die energie geabsorbeer of vrygestel per mol in a chemiese reaksie.

(2)

7.2

Endothermic ✓

More energy is absorbed than released ✓ **OR** $\Delta H > 0$

Endotermies

*Meer energie is geabsorbeer as vrygestel **OF** $\Delta H > 0$*

(2)

7.3

7.3.1 544 (kJ/kJ·mol⁻¹) ✓✓

(2)

7.3.2 131 (kJ/kJ·mol⁻¹) ✓✓

(2)

[8]

QUESTION 8/VRAAG 8

8.1

8.1.1 An acid is a proton donor. ✓✓

'n Suur is 'n protonskenker.

(2)

8.1.2 HNO₃ and/en NO₃⁻ ✓✓

OR/OF

H₂O and/en H₃O⁺

(2)

8.1.3 Acidic/Suur ✓

Hydronium ions/H₃O⁺ formed in water. ✓

Hidroniumione/H₃O⁺ vorm in water.

(2)

8.1.4

Marking guidelines/Nasienriglyne

If any of the underlined key words/phrases are omitted: minus 1 mark
*Indien enige van die onderstreepte sleutelwoorde/frases uitgelaat is:
minus 1 punt*

An ampholyte is a substance that can act as either acid or base. ✓✓
'n Amfoliet is 'n stof wat as suur of basis kan optree.

(2)

8.1.5 H₂O ✓

8.1.6 Reaction 1: It/H₂O reacts as base/accepts a proton or H⁺. ✓

Reaction 2: It/H₂O reacts as acid/donates a proton or H⁺. ✓

(2)

8.1.7

<p>Marking guidelines/Nasienriglyne</p> <ul style="list-style-type: none"> Substitute 0,1 dm³ & 0,2 mol·dm⁻³ in formula/ratio. ✓ Vervang 0,1 dm³ & 0,2 mol·dm⁻³ in formule/verhouding. Use ratio/Gebruik verhouding: n(dilute/verdu) = n(concentrated/gekonsentreerd) ✓ Substitute 0,02 mol & 0,16 mol·dm⁻³ in formula/ratio. Vervang 0,02 mol & 0,16 mol·dm⁻³ in formule/verhouding. Final answer/Finale antwoord: 0,025 dm³ / 25 cm³ ✓ 	
<p>OPTION 1/OPSIE 1</p> $c = \frac{n}{V}$ $0,2 = \frac{n}{0,1} \checkmark$ $\therefore n(\text{conc/gekons}) = 0,02 \text{ mol}$ $= n(\text{dilute/verdu}) \checkmark$ $c = \frac{n}{V}$ $0,16 = \frac{0,02}{V} \checkmark$ $V = 0,125 \text{ dm}^3$ <p>Amount added/Hoeveelheid bygevoeg: 0,125 – 0,1 = 0,025 dm³ ✓</p>	<p>OPTION 2/OPSIE 2</p> $c_1V_1 = c_2V_2$ $(0,2)(100) \checkmark = (0,16)V_2 \checkmark \checkmark$ $V_2 = 125 \text{ cm}^3$ <p>Amount added/Hoeveelheid bygevoeg: 125 – 100 = 25 cm³ ✓</p>

(4)

8.2

8.2.1

$$c = \frac{n}{V} \checkmark$$

$$0,16 = \frac{n}{0,08} \checkmark$$

$$n = 0,0128 \text{ mol}$$

$$n(\text{ZnO}) = \frac{1}{2}n(\text{HNO}_3)$$

$$= \frac{1}{2}(0,0128) \checkmark$$

$$= 0,0064$$

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

$$0,0064 = \frac{m}{81} \checkmark$$

$$m = 0,52 \text{ g} \checkmark$$

Marking guidelines/Nasienriglyne

- Formula/Formule: $n = \frac{m}{M} / c = \frac{n}{V} \checkmark$
- Substitute/Vervang 0,16 dm³·mol⁻¹ & 0,08 dm³ in $c = \frac{n}{V}$ /ratio/verhouding ✓
- Use ratio/Gebruik verhouding:
 $n(\text{ZnO}) = \frac{1}{2}n(\text{HNO}_3) \checkmark$
- Substitute/Vervang 81 g·mol⁻¹ in
 $n = \frac{m}{M}$ /ratio/verhouding. ✓
- Final answer/Finale antwoord:
0,52 g ✓

(5)

8.2.2

Zinc nitrate/Sinknitraat ✓
Zn(NO₃)₂ ✓

(2)

[21]

QUESTION 9/VRAAG 9

9.1 A reaction in which electrons are transferred. ✓✓
'n Reaksie waar elektrone oorgedra word. (2)

9.2
9.2.1 +7 ✓ (1)

9.2.2 +2 ✓ (1)

9.3. Reduction/Reduksie ✓
The oxidation number decreased. ✓
Die oksidasie getal verminder.
OR
Electrons are gained./Elektrone is opgeneem. (2)

9.4 (Reaction/reaksie) 1 ✓
Oxidation number (of S) decreases ✓ from +4 (in SO₂) to 0 (in S).
Oksidasiegetal (van S) neem af van +4 (in SO₂) na 0 (in S).

OR/OF
SO₂ gains electrons./SO₂ neem elektrone op.

OR/OF
In reaction 2, the oxidation number (of S) increases from +4 (in SO₂) to +6 (in SO₄²⁻).
In reaksie 2, neem die oksidasiegetal (van S) toe van +4 (in SO₂) na +6 in SO₄²⁻. (2)

9.5 H₂S → S + 2H⁺ + 2e⁻ ✓✓

Marking guidelines/Nasienriglyne

• H ₂ S ⇌ S + 2H ⁺ + 2e ⁻ 1/2	S + 2H ⁺ + 2e ⁻ ← H ₂ S 1/2
S + 2H ⁺ + 2e ⁻ ⇌ H ₂ S 0/2	S + 2H ⁺ + 2e ⁻ → H ₂ S 0/2

• Ignore if charge on electron is omitted./Ignoreer indien lading op elektron uitgelaat is.
• If charge on ion omitted e.g. S + 2H + 2e⁻ → H₂S
Indien lading op ion uitgelaat is bv. S + 2H + 2e⁻ → H₂S Max/Maks. 1/2 (2)

9.6 H₂S → S + 2H⁺ + 2e⁻ (x2)
SO₂ + 4H⁺ + 4e⁻ → S + 2H₂O ✓
2H₂S + SO₂ ✓ → 3S + 2H₂O ✓ Bal. ✓

IF/INDIEN
No half-reactions shown/Geen halfreaksies getoon nie:
Max/Maks. 1/2 (4)

[14]

QUESTION 10/VRAAG 10

- 10.1 Cyanide/CN⁻/It is toxic. ✓
Sianied/CN⁻/Dit is giftig. (1)
- 10.2 Basic/Basies ✓
Hydroxide is a base./Hidroksied is 'n basis. ✓ (2)
- 10.3 +1 ✓ (1)
- 10.4 Au ✓ (1)
- 10.5 Oxidation/Oksidasie ✓ (1)
- 10.6 $Zn \rightarrow Zn^{2+} + 2e^{-}$ ✓✓

Marking guidelines/Nasienriglyne

- $Zn \rightleftharpoons Zn^{2+} + 2e^{-} \quad \frac{1}{2}$ $Zn^{2+} + 2e^{-} \leftarrow Zn \quad \frac{1}{2}$
 $Zn^{2+} + 2e^{-} \rightleftharpoons Zn \quad \frac{0}{2}$ $Zn^{2+} + 2e^{-} \rightarrow Zn \quad \frac{0}{2}$
- Ignore if charge on electron is omitted./Ignoreer indien lading op elektron uitgelaat is.
- If charge on ion omitted e.g. $Zn \rightarrow Zn + 2e^{-}$
Indien lading op ion uitgelaat is bv. $Zn \rightarrow Zn + 2e^{-}$ Max/Maks. $\frac{1}{2}$ (2)

- 10.7 $\%Au = \frac{197}{272} \times 100$ ✓
 $= 72,42\%$ ✓ (2)
- [10]**

TOTAL/TOTAAL: 150

GRAPH SHEET/GRAFIEKPAPIER

**SUBMIT THIS GRAPH SHEET WITH THE ANSWER BOOK.
LEWER HIERDIE GRAGIEKPAPIER SAAM MET DIE ANTWOORDEBOEK IN.**

NAME/NAAM _____ CLASS/KLAS _____

QUESTION/VRAAG 4.2

**Graph of pressure versus inverse of volume
Grafiek van druk teenoor omgekeerde van volume**

