



basic education

Department:
Basic Education
REPUBLIC OF SOUTH AFRICA

**NATIONAL
SENIOR CERTIFICATE
NASIONALE
SENIOR SERTIFIKAAT**

GRADE/GRAAD 11

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

EXEMPLAR/MODEL 2013

MEMORANDUM

MARKS/PUNTE: 150

**This memorandum consists of 11 pages.
Hierdie memorandum bestaan uit 11 bladsye.**

QUESTION 1/VRAAG 1

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

QUESTION 2/VRAAG 2

- | | | |
|-------|--|-----|
| 2.1 | Covalent bond/Kovalente binding ✓ | (1) |
| 2.2 | 5/Five/Vyf ✓ | (1) |
| 2.3 | <div style="display: inline-block; vertical-align: middle;"> $\begin{array}{c} \text{H} \\ \times \times \times \\ \times \text{N} \times \\ \times \times \times \\ \text{H} \end{array}$ </div> <div style="display: inline-block; vertical-align: middle; border-left: 1px solid black; padding-left: 10px;"> <p>Criteria/Riglyne:</p> <ul style="list-style-type: none"> Symbols of one nitrogen atom and three hydrogen atoms shown with two electrons shown as dots/crosses between them. ✓
 <i>Simbole van twee stikstofatome en drie waterstofatome getoon met twee elektrone aangedui as kolle/kruise tussen hulle. ✓</i> Two additional electrons (one electron pair) placed around nitrogen atoms.
 <i>Twee addisionele elektrone (een elektronpaar) geplaas om die stikstofatoom. ✓</i> </div> | (2) |
| 2.4 | | |
| 2.4.1 | 4 ✓ | (1) |
| 2.4.2 | 3 ✓ | (1) |
| 2.4.3 | Pyramidal /Pirimidaal ✓ | (1) |
| 2.5 | Dative covalent bond/Datiefkovalente binding ✓ | (1) |

- 2.6
$$\begin{array}{c} \text{H} \checkmark \\ \times \text{N} \times \times \text{H} \\ \times \text{O} \times \times \text{H} \\ \times \text{O} \times \times \text{H} \\ \text{H} \end{array} + \text{H}^+ \rightarrow \left[\begin{array}{c} \text{H} \\ \times \text{N} \times \times \text{H} \\ \times \text{O} \times \times \text{H} \\ \times \text{O} \times \times \text{H} \\ \text{H} \end{array} \right]^+ \checkmark \checkmark$$
 (4)
- 2.7 (1)
- 2.7.1 4 ✓ (1)
- 2.7.2 Tetrahedral/Tetraëdries ✓ (1)
- 2.8 II ✓
Triple bond is stronger than a single bond. ✓
Drievoudige binding/trippelbinding is sterker as 'n enkelbinding. (2)
- [16]

QUESTION 3/VRAAG 3

- 3.1 Gas ✓ (1)
- 3.2 Induced dipole forces/Geïnduseerde dipoolkragte ✓ (1)
- 3.3 From CH_4 to SnH_4 /top to bottom the molecular size increases. ✓
Therefore the strength of intermolecular forces/Van der Waals forces/induced dipole forces increases, ✓ resulting in an increase in boiling point. ✓
Van CH_4 na SnH_4 /bo na onder neem die molekulêre grootte toe.
Dus neem die sterkte van intermolekulêre kragte/Van der Waalskragte/geïnduseerde dipoolkragte toe, wat tot gevolg het dat die kookpunt toeneem. (3)
- 3.4 (1)
- 3.4.1 Hydrogen sulphide/Waterstofsulfied ✓ (1)
- 3.4.2 Water ✓
- OR/OF**
hydrogen oxide/waterstofoksied (1)
- 3.4.3 Water ✓
- OR/OF**
hydrogen oxide/waterstofoksied (1)
- 3.5 Water has a boiling point much higher than the other three hydrides due to the presence of strong hydrogen bonds and therefore ✓
more energy is needed to overcome intermolecular forces. ✓
Water se kookpunt is baie hoër as dié van die ander drie hidriede weens sterk waterstofbindings en dus is meer energie nodig om intermolekulêre kragte te oorkom. (2)
- [10]

QUESTION 4/VRAAG 4

4.1

4.1.1 $p \propto \frac{1}{V}$ **OR/OF** $V \propto \frac{1}{p}$ ✓ (1)

4.1.2 Boyle's law/Boyle se wet ✓ (1)

4.1.3 As the volume of the container decreases, the number of collisions per unit area ✓ on the walls of the container increases ✓
Soos die volume van die houer afneem, neem die aantal botsings per eenheidsoppervlakte teen die wande van die houer toe. (2)

4.2 Mass ✓ & temperature ✓ / Massa & temperatuur

ANY TWO/ENIGE TWEE:

- Wait a while after increasing the pressure before taking a volume reading. ✓
Wag 'n rukkie voordat die volumelesing geneem word nadat die druk verhoog is. ✓
- Increase the pressure in small amounts to limit the temperature change. ✓
Verhoog die druk in klein hoeveelhede om die temperatuurstyging te beperk.
- Same mass of gas is trapped (in tube)./ensure that there is no leakage of gas
Dieselfde massa gas is vasgevang (in buis)./ maak seker dat daar geen lekkasie van die gas is nie (4)

4.3 30cm^3 ✓ (1)

4.4 $p_1V_1 = p_2V_2$ ✓
 $(120)(30) \checkmark = p_2(5) \checkmark$
 $\therefore p_2 = 720 \text{ kPa}$ ✓

Notes/Aantekeninge

May use any set of values from the graph that gives the correct answer.
Mag enige stel waardes op die grafiek wat die korrekte antwoord gee gebruik. (4)

4.5 High pressures / Hoë drukke
 Low temperatures / Lae temperature (3)

QUESTION 5/VRAAG 5

5.1 $pV = nRT$ ✓
 $(108 \times 10^3) \text{ ✓ } (53,3 \times 10^{-3}) \text{ ✓ } = n(8,31)(294) \text{ ✓}$
 $\therefore n = 2,36 \text{ mol}$

$n(\text{CaH}_2) = \frac{1}{2}n(\text{H}_2) \text{ ✓ } = 1,18 \text{ mol}$

$m(\text{CaH}_2) = nM \text{ ✓}$
 $= (1,18)(42) \text{ ✓}$
 $= 49,56 \text{ g ✓}$

(8)

5.2 Increases/Vermeerder ✓✓

(1)

[9]

QUESTION 6/VRAAG 6

6.1 The amount of heat/energy released or absorbed in a reaction ✓✓
 Die hoeveelheid hitte/energie in 'n reaksie vrygestel of geabsorbeer

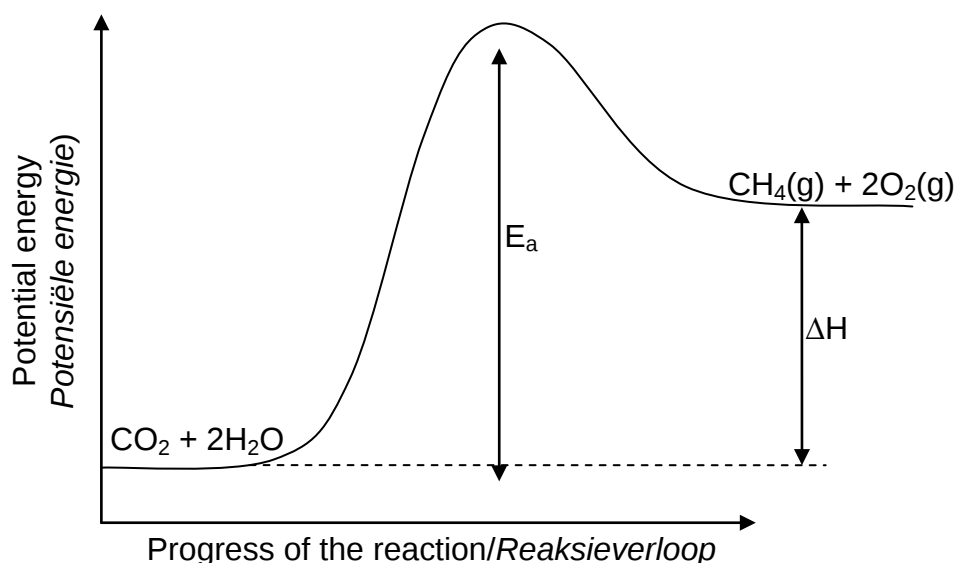
(2)

6.2 Positive/Positief ✓

The energy of the products is greater than energy of the reactants less ✓
 Die energie van die produkte is meer as die energie van die reaktanse.

(2)

6.3



Marking criteria/Nasienriglyne:

Labelled axes/Benoemde asse ✓

Shape/Vorm ✓

Position of reactants/Posisie van reaktanse ✓

Position of products/Posisie van produkte ✓

ΔH ✓

Activation energy / Aktiveringsenergie

(6)

[10]

QUESTION 7/VRAAG 7

7.1

$$\begin{aligned} n(\text{N}_2) &= \frac{N}{N_A} \checkmark \\ &= \frac{2,53 \times 10^8}{6,02 \times 10^{23}} \checkmark \\ &= 4,2 \times 10^{-16} \text{ mol} \end{aligned}$$

2 mol NaN_3 produces//lewer 3 mol N_2

$$\begin{aligned} \therefore n(\text{NaN}_3) &= \frac{2}{3} (4,2 \times 10^{-16}) \checkmark \\ &= 2,80 \times 10^{-16} \text{ mol} \checkmark \end{aligned}$$

(4)

7.2

POSITIVE MARKING FROM QUESTION 71.1.
POSITIEWE NASIEN VAN VRAAG 7.1.1.

$$\begin{aligned} n(\text{N}_2) &= \frac{V}{V_m} \checkmark \\ \therefore 4,2 \times 10^{-16} &= \frac{V}{22,4} \checkmark \\ \therefore V &= 9,41 \times 10^{-15} \text{ dm}^3 \checkmark \end{aligned}$$

(3)
[7]

QUESTION 8/VRAAG 8

8.1

$$\begin{aligned} n[\text{Al}_2(\text{SO}_4)_3] &= \frac{m}{M} \\ &= \frac{700}{342} \checkmark \\ &= 2,05 \text{ mol} \\ \downarrow \\ n[\text{Al}(\text{OH})_3] &= 2(2,05) \checkmark = 4,09 \text{ mol} \\ m[\text{Al}(\text{OH})_3] &= nM \\ &= (4,09)(78) \checkmark \\ &= 319,30 \text{ g} \checkmark \end{aligned}$$

✓ Any formula
Enige formule

Note/Aantekening

Although the answer of each calculation can be shown as rounded to two decimal places, the actual answer obtained on the calculator should be kept and then rounding should only take place in the final answer.
Hoewel die antwoord van elke berekening getoon kan word as afgerond tot twee desimale plekke, moet die werklike waarde op die sakrekenaar behou word en afronding moet slegs in die finale antwoord gedoen word.

(5)

- 8.2 Amount of solute/dissolved substance ✓
 per cubic decimetre of solution. ✓
Hoeveelheid opgeloste stof
Per kubieke sentimeter van oplossing. (2)

8.3
$$c(\text{Na}_2\text{SO}_4) = \frac{n}{V} \checkmark$$

$$= \frac{0,85}{250 \times 10^{-3}} \checkmark$$

$$= 3,40 \text{ mol} \cdot \text{dm}^{-3} \checkmark$$
 (3)
[10]

QUESTION 9/VRAAG 9

- 9.1 A reactant whose amount limits/determines the amount of product obtained in a chemical reaction. ✓✓
Die reaktans waarvan die hoeveelheid die hoeveelheid produk wat in 'n chemiese reaksie verkry word, beperk/bepaal.

OR/OF

The reactant that produces the least amount of product. ✓✓
Die reaktans wat die minste hoeveelheid produk sal lewer.

OR/OF

The reactant that will be used up first during a chemical reaction. ✓✓
Die reaktans wat eerste opgebruik word tydens 'n chemiese reaksie. (2)

9.2
$$n(X) = \frac{m}{M}$$

$$= \frac{14}{138} \checkmark$$

$$= 0,10 \text{ mol}$$

$$n(Y) = \frac{m}{M}$$

$$= \frac{10}{102} \checkmark$$

$$= 0,10 \text{ mol}$$

✓ Any formula
 Enige formule

From balanced equation/Uit gebalanseerde vergelyking:

2(X) reacts with/reageer met 1n(Y)

∴ 0,1 mol of X needs/benodig 0,05 mol of Y ✓

The limiting reactant is X./Die beperkende reaktans is X. ✓ (5)

9.3 **POSITIVE MARKING FROM QUESTION 9.2.**

POSITIEWE NASIEN VAN VRAAG 9.2.

$$n(\text{aspirin produced/aspirien berei}) = n(X) = 0,10 \text{ mol}$$

$$n(\text{aspirin/aspirien}) = \frac{m}{M} \checkmark$$

$$\therefore 0,1 = \frac{m}{180} \checkmark$$

$$\therefore m(\text{aspirin/aspirien}) = 18 \text{ g} \quad (18,26 \text{ g})$$

$$\begin{aligned} \% \text{ yield} &= \left(\frac{\text{actual yield}}{\text{theoretical yield}} \right) 100 \quad / \quad \% \text{ opbrengs} = \left(\frac{\text{werklike opbrengs}}{\text{teoretiese opbrengs}} \right) 100 \\ &= \frac{11,5}{18} \checkmark (100) \checkmark \\ &= 63,90\% \checkmark \quad (62,98\%) \end{aligned}$$

Note/Aantekening

Although the answer of each calculation can be shown as rounded to two decimal places, the actual answer obtained on the calculator should be kept and then rounding should only take place in the final answer.

Hoewel die antwoord van elke berekening getoon kan word as afgerond tot twee desimale plekke, moet die werklike waarde op die sakrekenaar behou word en afronding moet slegs in die finale antwoord gedoen word.

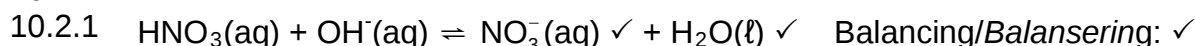
(5)
[12]

QUESTION 10/VRAAG 10



(1)

10.2



Note/Aantekening

Phases are not required for marking purposes.

Fases word nie vir nasiendoeleindes verwag nie.

(3)



OR/OF



Note/Aantekening

2 marks or zero./2 punte of nul.

(2)

10.3

10.3.1 $c = \frac{n}{V} \checkmark$ OR/OF $n = cV$

$$n_{\text{base/basis}} = (0,025 \times 0,05) \\ = 1,25 \times 10^{-3} \text{ mol } \checkmark$$

(2)

10.3.2 1 mol base reacts with 2 mol acid / 1 mol basis reageer met 2 mol suur
 Mole acid/Mol suur = $2 \times 1,25 \times 10^{-3}$
 $= 2,5 \times 10^{-3} \text{ mol } \checkmark$

(1)

10.3.3 $c = \frac{n}{V}$ OR $n = cV$
 $= \frac{2,5 \times 10^{-3}}{0,04} \checkmark$
 $= 6,25 \times 10^{-2} \text{ mol} \cdot \text{dm}^{-3} \checkmark$

(2)

[11]

QUESTION 11/VRAAG 11

11.1 Loss of electrons./Verlies aan elektrone. $\checkmark \checkmark$

(2)

11.2

11.2.1 Zn $\checkmark$

(1)

11.2.2 CO $\checkmark$

Oxidation number of C increases from +2 to +4 $\checkmark$

Thus C is oxidised $\checkmark$ and acts as reducing agent.

Oksidasiegetal van C neem toe van +2 na +4.

Dus word C geoksideer en tree as reduseermiddel op.

(3)

11.3 $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^- \checkmark$ (oxidation/oksidasie) x3

$\text{NO}_3^- + 4\text{H}^+ + 3\text{e}^- \rightarrow \text{NO} + 2\text{H}_2\text{O} \checkmark$ (reduction/reduksie) x2

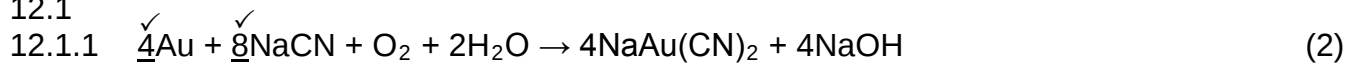
$3\text{Cu} + 8\text{H}^+ + 2\text{NO}_3^- \checkmark \rightarrow 3\text{Cu}^{2+} + 2\text{NO} + 4\text{H}_2\text{O} \checkmark$ Bal. $\checkmark$

(5)

[11]

QUESTION 12/VRAAG 12

12.1



12.1.2 Cyanidation/*Sianidering* $\checkmark$ (1)

12.1.3 Redox/*Redoks* $\checkmark$ (1)

12.1.4 Basic/*Basies* $\checkmark$
NaOH is a product of the reaction between gold ore and NaCN. $\checkmark$ (2)

12.1.5 **ANY ONE/ENIGE EEN:**

- Pollution and poisoning caused by leaching of chemicals used during extraction into water or atmosphere. $\checkmark$
Besoedeling weens insyfering van chemikalieë gebruik tydens ontginning in water of atmosfeer.
- Cyanide is known as a poison that is lethal to humans and animals.
Sianied is bekend as 'n gif en dodelik vir mens en dier.
- Mining disturbs the soil around the mine and can cause erosion.
Mynbou versteur die grond rondom die myn en veroorsaak erosie. (1)

12.2

12.2.1 Precipitation/*Presipitasie* $\checkmark$ (1)

12.2.2 Transition metal/*Oorgangsmetaal* $\checkmark$ (1)

12.2.3 More reactive/*Meer reaktief* $\checkmark$ (1)

12.3

12.3.1 Creates jobs/Skep werk ✓

A lot of money can be generated from gold resources (economy of the country grows)./Baie geld kan uit goudbronne gegenereer word (ekonomie van land groei). ✓

(2)

12.3.2 **ANY TWO/ENIGE TWEE**

- Destruction of natural ecosystem. ✓
Vernietiging van natuurlike ekosisteem.
- Moving of people from areas where they have lived for a long time.
Verskuiwing van mense uit gebiede waar hulle reeds lank woon.
- Mining can make the surrounding land unstable and unsafe to build on.
Mynbou kan die omliggende gebied onstabiel maak en onveilig om op te bou.
- Pollution as a result of energy needed for the extraction of the metal. ✓
Besoedeling as gevolg van energie benodig vir ontginning van metaal.
- The destruction of the surrounding landscape. ✓
Vernietiging van omliggende landskap.

(2)

12.4 **ANY TWO/ENIGE TWEE:**

- Size of the ore body. ✓✓
Grootte van ertsneerslag.
- Amount of gold in the ore. ✓✓
Hoeveelheid goud in erts.
- Depth at which the gold is located influences the mine cost.
Diepte waarop goud voorkom beïnvloed koste van myn.
- Price of gold compared to the cost of mining.
Prys van goud in vergelyking met koste van mynbou.
- Infrastructure available (housing for employees, roads, water, electricity, school, hospitals, etc).
Beskikbare infrastruktuur (behuising vir werkers, paaie, water, elektrisiteit, skole, hospitale, ens.)
- Cost of establishing infrastructure.
Koste van infrastruktuurontwikkeling.

(4)

[18]

TOTAL/TOTAAL: 150