education

Department of Education
FREE STATE PROVINCE

EXAMINATION/*EKSAMEN*

GRADE 11 / *GRAAD 11*

PHYSICAL SCIENCES (P2)
FISIESE WETENSKAPPE (V2)

MEMORANDUM

NOVEMBER 2022

MARKS: 100 / *PUNTE: 100*

TIME: 2 HOURS / *TYD: 2 UUR*

This memorandum consists of eight pages.
Hierdie memorandum bestaan uit agt bladsye.

QUESTION 1 / *VRAAG 1*

1.1	D✓✓	1.2	B✓✓	1.3	D✓✓	1.4	A✓✓
1.5	D✓✓	1.6	D✓✓	1.7	D✓✓	1.8	B✓✓
1.9	B✓✓	1.10	C✓✓				

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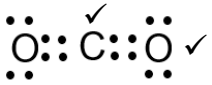
QUESTION 2 / *VRAAG 2*

2.1.1

Marking guidelines / *Nasienriglyne*
If any one of the underlined key phrases in the **correct context** is omitted, deduct one mark. This is also valid for similar questions.
*Trek een punt af as enige van die onderstreepte sleutelfrases in die **korrekte konteks** uitgelaat is. Hierdie geld ook vir soortgelyke vrae.*

A group of two or more atoms covalently bonded✓ and that functions as a unit.✓
'n Groep van twee of meer atome wat kovalent gebind is en as 'n eenheid optree. (2)

2.1.2  ✓

Marking criteria / *Nasienriglyne*
- Double bond between carbon and each oxygen atom. ✓
  Dubbelbinding tussen koolstof en elke suurstofatoom.
- Two oxygen atoms each with two lone pairs of electrons. ✓
  Twee suurstofatome met twee alleenpaarelektrone op elk.

(2)

2.1.3 Linear/*Lineêr* ✓ (1)

2.1.4
$$\Delta E = EN(O) - EN(C)$$
$$= 3{,}5 - 2{,}5$$
$$= 1 \checkmark$$
(1)

2.1.5 Non-polar/*Nie-polêr* ✓ (1)

2.2.1 Bond length / *Bindingslengte* ✓ (1)

2.2.2 T **OR/*OF*** S ✓ (1)

2.2.3 Exothermic/*Eksotermies* ✓
- As the molecules move closer to each other, the potential energy decreases. ✓
  Soos die molekule nader aan mekaar beweeg, verminder die potensiële energie.
  OR/*OF*
- Energy is released while the bond is formed.
  Energie word uitgegee terwyl die binding gevorm word. (2)

2.2.4 Increases / *Neem toe* ✓
- Forces of repulsion increase. / *Afstotingskragte neem toe*. ✓ (2)

[13]

QUESTION 3 / *VRAAG 3*

3.1.1 The pressure exerted by a vapour at equilibrium with its liquid in a closed system ✓✓(**2 or 0**)
Die druk uitgeoefen deur 'n damp in ewewig met sy vloeistof in 'n geslote sisteem. (**2 of 0**) (2)

3.1.2 HF ✓ (1)

3.1.3
- Between the HF molecules are hydrogen bonds. ✓
- Between the HCℓ molecules are dipole-dipole forces. ✓
- The intermolecular forces between the HF molecules are stronger than those between HCℓ molecules. ✓
  OR
  Hydrogen bonds are stronger than dipole-dipole forces.
  OR
  The intermolecular forces between HCℓ molecules are weaker than those between HF molecules.
  OR
  Dipole-dipole forces are weaker than hydrogen bonds.
- More energy is needed to overcome the intermolecular forces between HF molecules. ✓
  OR
  Less energy is needed to overcome the intermolecular forces between HCℓ molecules.

- *Tussen die HF-molekule is waterstofbindings*. ✓
- *Tussen die HCℓ-molekule is dipool-dipoolkragte*. ✓
- *Die intermolekulêre kragte tussen die HF-molekule is sterker as dié tussen die HCℓ-molekule*. ✓
  OF
  Waterstofbindings is sterker as dipool-dipoolkragte.
  OF
  Die intermolekulêre kragte tussen HCℓ-molekule is swakker as dié tussen HF-molekule.
  OF
  Dipool-dipoolkragte is swakker as waterstofbindings.
- *Meer energie is nodig om die intermolekulêre kragte tussen HF-molekule te oorkom.* ✓
  OF
  Minder energie is nodig om die intermolekulêre kragte tussen HCℓ-molekule te oorkom. (4)

3.2.1 The temperature at which the solid and the liquid phases of a substance are at equilibrium. ✓✓ (**2 or 0**)
Die temperatuur waarby die vaste- en vloeistoffases van 'n stof in ewewig is. (2)

3.2.2 B ✓ (1)

3.2.3
- HI has a larger molecular mass/size than HBr and HCℓ has a smaller molecular mass/size than HBr. ✓
- The intermolecular forces between HI molecules are stronger than those between HBr molecules, but the intermolecular forces between HCℓ molecules are weaker than those between HBr molecules. ✓
- More energy is needed to overcome the intermolecular forces between HI molecules compared to HBr, but less energy is needed to overcome the intermolecular forces between HCℓ molecules compare to HBr. ✓

- *HI het 'n groter molekulêre massa as / is 'n groter molekuul as HBr en HCℓ het 'n kleiner molekulêre massa as / is 'n kleiner molekuul as HBr*. ✓
- *Die intermolekulêre kragte tussen HI-molekule is sterker as dié tussen HBr-molekule maar die intermolekulêre kragte tussen HCℓ-molekule is swakker as dié tussen HBr-molekule.* ✓
- *Meer energie is nodig om die intermolekulêre kragte tussen HI-molekule te oorkom in vergelyking met HBr, maar minder energie is nodig om die intermolekulêre kragte tussen HCℓ-molekule te oorkom in vergelyking met HBr.* ✓ (3)

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QUESTION 4 / *VRAAG 4*

4.1 Any three: ✓✓✓
- The particles occupy no volume.
- The particles exert no intermolecular forces on one another.
- The particles are identical.
- Collisions between the particles and the sides of the container are perfectly elastic.

Enige drie:
- *Die deeltjies beslaan geen volume nie.*
- *Die deeltjies oefen geen intermolekulêre kragte op mekaar uit nie.*
- *Die deeltjies is identies.*
- *Botsings tussen die deeltjies en die wande van die houer is volkome elasties*.

(3)

4.2 Low pressure ✓ Lae druk
High temperature ✓ Hoë temperatuur (2)

4.3 M ✓ (1)

4.4 The molecules of a real gas themselves occupy volume. ✓
At very high pressure the volume of the molecules contributes to a significant part of the volume of the gas. ✓
Hence, the total volume of a real gas is greater than predicted for the ideal gas ✓(which means 1/V is smaller than for the ideal gas).

Die molekule van 'n ware gas beslaan self volume.
By baie hoë druk dra die volume van die molekule by tot 'n beduidende deel van die volume van die gas.
Daarom is die totale volume van 'n ware gas groter as wat vir die ideale gas voorspel is (wat beteken 1/V is kleiner as vir die ideale gas). (3)

4.5 $p \propto \frac{1}{V}$ ✓✓ **OR/*OF*** $V \propto \frac{1}{p}$ (2)

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QUESTION 5 / *VRAAG 5*

5.1.1 Accept correct alternatives. / *Aanvaar korrekte alternatiewe.*
(a) Substances/chemicals/NH_4NO_3 & NH_4OH (dissolved in water)/ solute ✓
Stowwe/chemikalieë/NH_4NO_3 & NH_4OH (opgelos in water)/ opgeloste stof (1)
(b) Type of reaction / Influence on temperature ✓
Soort reaksie / Invloed op temperatuur (1)
(c) Initial temperature of water / mass of solute / volume of H_2O ✓
Aanvanklike watertemperatuur / massa van opgeloste stof / volume H_2O (1)

5.1.2 1 ✓ Energy is absorbed. / Temperature drops. ✓
Energie word opgeneem. / Temperatuur daal. (2)

5.2.1 (a) Z ✓ (1)

(b) Y ✓ (1)

5.2.2 Activation energy / *Aktiveringsenergie* = 250 - 25 ✓
= 225 kJ ✓ (2)

[9]

QUESTION 6 / *VRAAG 6*

6.1 One mole of any gas occupies the same volume at the same temperature and pressure.✓✓(**2 or 0**)
Een mol van enige gas beslaan dieselfde volume by dieselfde temperatuur en druk. (2)

6.2 $CaCO_3$/calcium carbonate/*kalsiumkarbonaat* ✓ (1)

6.3

• m(pure $CaCO_3$) = $\frac{83}{100} \times 25$ ✓ • Formula m = nM ✓ • Substitute m and M in m=nM ✓	Formula m = nM ✓ n(impure $CaCO_3$) = $\frac{25}{100}$ ✓ n(pure $CaCO_3$) = $\frac{83}{100} x\ n(impure)$ ✓

• Mole ratio: $n(CO_2) = n(CaCO_3)$ ✓
• Substitute $n(CO_2)$ and 24 000 cm^3 / 24 dm^3 in n = $\frac{V}{V_m}$ ✓
• Answer: 4 980 cm^3 / 4,98 dm^3 ✓

OPTION 1 / *OPSIE 1*

m (pure/*suiwer* $CaCO_3$) = $\frac{83}{100} \times 25$ ✓
= 20,75 g
n (pure/*suiwer* $CaCO_3$) = $\frac{m}{M}$ ✓
= $\frac{20,75}{100}$ ✓
= 0,2075 mol

n (CO_2) = n ($CaCO_3$) ✓
= 0,2075 mol

n (CO_2) = $\frac{V}{V_m}$
0,2075 = $\frac{V}{24\ 000}$ ✓

V = 4 980 cm^3 **or/of** 4,980 dm^3 ✓

OPTION 2 / *OPSIE 2*

n (impure/*onsuiwer* $CaCO_3$) = $\frac{m}{M}$ ✓
= $\frac{25}{100}$ ✓
= 0,25 mol

n (pure/*suiwer* $CaCO_3$) = $\frac{83}{100} \times 0,25$ ✓
= 0,2075 mol

Same / *Dieselfde*

(6)

6.4 Increases/*Toeneem* ✓ (1)
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QUESTION 7 / *VRAAG 7*

7.1.1 The simplest whole-number ratio of atoms in a compound. ✓
Die eenvoudigste heelgetal verhouding van atome in 'n verbinding. (1)

7.1.2

	Carbon *Koolstof*	Hydrogen *Waterstof*	Oxygen *Suurstof*	
$n = \frac{m}{M}$	$n = \frac{39,9}{12}$ $= 3,325\ mol$	$n = \frac{6,7}{1}$ $= 6,7\ \text{mol}$	$n = \frac{53,4}{16}$ $= 3,338\ \text{mol}$	✓
Simplest ratio	$\frac{3,325}{3,325} = 1$	$\frac{6,7}{3,325} = 2$	$\frac{3,338}{3,325} = 1$	✓

$n = \frac{60}{30}$
$= 2$ ✓ Empirical formula / *Empiriese formule*: CH_2O ✓
Molecular formula / *Molekulêre formule*: $C_2H_4O_2$ ✓ (5)

7.2

Marking criteria / *Nasienriglyne*
$c = \frac{n}{V}$ ✓
Substitute 0,4 mol·dm^{-3} en 0,25 dm^3 in $c = \frac{n}{V}$ ✓
Vervang 0,4 mol·dm^{-3} en 0,25 dm^3 in $c = \frac{n}{V}$
n(XNO_3) = 2n($MgC\ell_2$) ✓
Substitute 34 g and n(XNO_3) in n = $\frac{m}{M}$ ✓
Vervang 34 g en n(XNO_3) in n = $\frac{m}{M}$
X= 170-62 ✓
Final answer / *Finale antwoord*: Ag/silver/*silwer* ✓

c($MgC\ell_2$) = $\frac{n}{V}$ ✓
0,4 = $\frac{n}{0,25}$ ✓
n ($MgC\ell_2$) = 0,1 mol
n(XNO_3) = (2)(0,1) ✓ = 0,2 mol

n(XNO_3) = $\frac{m}{M}$
0,2 = $\frac{34}{M}$ ✓
M(xNO_3) = 170 g·mol^{-1}
M(xNO_3) =X+14+3(16)
X=170-62 ✓
X: Ag/Silver ✓

(6)
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QUESTION 8 / *VRAAG 8*

8.1 Burette/Buret ✓ (1)

8.2.1 Yellow/*Geel* ✓ (1)
8.2.2 Blue/*Blou* ✓ (1)

8.3.1

Marking criteria / *Nasienriglyne*
- Reactants/*Reaktante* ✓ Products/*Produkte* ✓ Bal ✓
- Ignore double arrow. / *Ignoreer dubbelpyl*.
- Marking rule 6.3.10 / Nasienreël 6.3.10

$\underline{2NaOH + H_2SO_4} \rightarrow \underline{Na_2SO_4 + 2H_2O}$ (3)

8.3.2 **POSITIVE MARKING FROM 8.3.1. / *POSITIEWE NASIEN VANAF 8.3.1.***

Marking criteria
- $c = \frac{n}{v}$✓
- Substitute 2 mol.dm^{-3} and 0,05 dm^3 in $c = \frac{n}{v}$ ✓
  Vervang 2 mol.dm^{-3} and 0,05 dm^3 in $c = \frac{n}{v}$
- $n = \frac{m}{M}$ ✓
- n(NaOH)= 2n(H_2SO_4) = 0,2 mol ✓
- Substitute/*Vervang* 40 g·mol^{-1} in $n = \frac{m}{M}$ ✓
- m(NaOH) = 8 g✓

c(H_2SO_4) = $\frac{n}{V}$ ✓
2 = $\frac{n}{0,05}$ ✓
n(H_2SO_4) = 0,1 mol

n(NaOH) = $\frac{m}{M}$ ✓
0,2 ✓ = $\frac{m}{40}$ ✓
m(NaOH) = 8 g ✓

(6)

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GRAND TOTAL / *GROOTTOTAAL*: 100

Addendum

8.3.2

Marking criteria

- c = $\frac{n}{v}$✓ or $\frac{C_aV_a}{C_bV_b} = \frac{n_a}{n_b}$✓
- Substitution of 2 mol.dm^{-3}and 0,05 dm^3 in c = $\frac{n}{v}$ ✓
- Use molar ratio : n(COOH)$_2$ = n(NaOH) 1:2✓
- n(NaOH)= 0,2 mol✓
- Substitute 40 g•mol^{-1} in the equation n = $\frac{m}{M}$✓
- Final answer : m(NaOH)= 8g✓

Option 2

$\frac{C_aV_a}{C_bV_b} = \frac{n_a}{n_b}$✓

$\frac{(2)(50)}{C_b(12,5)} = \frac{1}{2}$✓

c(NaOH) = 16 mol•dm^{-3}

c((COOH)$_2$) = $\frac{n}{V}$

16 = $\frac{n}{0,0125}$

n(NaOH) =0,2 mol

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

0,2 = $\frac{m}{40}$

m(NaOH) = 8 g

(6)