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NATIONAL SENIOR CERTIFICATE/ *NASIONALE SENIORSERTIFIKAAT*

GRADE/*GRAAD 11*

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PHYSICAL SCIENCES P2 MARKING GUIDELINE/ *FISIESE WETENSKAPPE V2 NASIENRIGLYN*

MARKS/*PUNTE*: 150

This marking guideline consists of 11 pages./
Hierdie nasienriglyn bestaan uit 11 bladsye.

QUESTION/*VRAAG 1*

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

QUESTION/*VRAAG 2*

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

2.2. 2.2.1 I_2 ✓ (1)

2.2.2 KBr ✓ (1)

2.2.3 NH_3 ✓ (1)

2.2.4 I_2 ✓ (1)

2.3 2.3.1 H:Ö:Cℓ: ✓✓ (2)

2.3.2 H:S:H ✓✓ (2)

2.4 2.4.1 Dative covalent bond / coordinate covalent bond ✓
Datiewe kovalente binding / koördinate-kovalente binding ✓ (1)

2.4.2

```
                         ⎛   H    ⎞+
H:N̤̈:H ✓ + H⁺ ✓ →   ⎜ H:N:H  ⎟   ✓✓
   H                     ⎝   H    ⎠
```

(4)

2.5 2.5.1 Bent / *Gebuig* ✓ (1)

2.5.2 Trigonal pyramidal / *Trigonaal piramidaal* ✓ (1)

2.6 Yes / *Ja* ✓ (1)

2.7 I_2 is a non-polar molecule and only contains London forces.✓
$CCℓ_4$ is a non-polar molecule and only contains London forces.✓
Both compounds are non-polar and only has London forces and "like dissolves like" ✓

I_2 is 'n nie-polêre molekule en bevat slegs London-kragte ✓
$CCℓ_4$ is 'n nie-polêre molekule en bevat slegs London-kragte ✓
Beide verbindings is nie-polêr en bevat slegs London-kragte en "soort los soort op" ✓ (3)

2.8 2.8.1 Bond energy is the energy needed to break one mole of its molecules into separate atoms.✓✓
Bindingsenergie is die energie benodig om een mol van sy molekule in aparte atome op te breek. ✓✓ (2)

2.8.2 The atomic size decreases in period (from C to F).
The bond length decreases the C to F atom. ✓
The shorter the bond length the more energy is needed to break them ✓
Die atomiesegrootte neem af in 'n periode (vanaf C na F).
Die bindingslengte neem vanaf C na F atoom af. ✓
Hoe korter die bindinglengte hoe meer energie word benodig om dit te breek ✓ (2)

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QUESTION/*VRAAG* 3

3.1 The temperature at which the vapour pressure of a substance equals atmospheric pressure. ✓✓
Die temperatuur waarby die dampdruk van 'n stof gelyk aan die atmosferiese druk is. ✓✓ (2)

3.2 YES./ *JA* ✓

Only one independent variable / All variables are controlled except molecular mass ✓
Slegs een onafhanklike veranderlike / Alle veranderlike behalwe vir molekulêremassa is beheer ✓ (2)

3.3 Gas ✓ (1)

3.4
- The molecular mass increases from A to D ✓
- The strength of the London forces increases with an increase in the molecular size/mass. ✓
- More energy will be required to overcome the intermolecular forces from A to D ✓

- *Die molekulêre massa neem toe vanaf A to D*
- *Die sterkte van die London-kragte neem toe met 'n toename in die molekulêremassa/grootte* ✓
- *Meer energie word benodig om die intermolekulêrekragte vanaf A tot D te oorkom* ✓

OR/*OF*

- The molecular mass decreases from D to A ✓
- The strength of the London forces decreases with decrease in molecular size/mass. ✓
- Less energy will be required to overcome the intermolecular forces from D to A ✓

- *Die molekulêre massa neem af vanaf D tot A* ✓
- *Die sterkte van die London-kragte neem af soos die molekulêremassa / grootte afneem* ✓
- *Minder energie word benodig om die intermolekulêrekragte vanaf D tot A te oorkom* ✓ (3)

3.5 Compound A / *Verbinding A* CH_4 ✓
It has the lowest boiling point / *Dit het die laagste kookpunt* ✓ (2)

3.6 3.6.1 Lower than / *Laer as* ✓ (1)

3.6.2
- HF has hydrogen bonds ✓
- HCℓ has dipole dipole forces ✓
- Hydrogen bonds are stronger than dipole dipole forces ✓
- More energy is needed to overcome intermolecular forces in HF ✓

- *HF het waterstofbinding*
- *HCℓ het dipool-dipoolkragte*
- Waterstofbinding is sterker as die dipool-dipoolkragte
- *Meer energie word benodig om die intermolekulêrekragte in HF te oorkom*

OR / *OF*

- HF has hydrogen bonds ✓
- HCℓ has dipole dipole forces ✓
- Dipole dipole forces is weaker than Hydrogen bonds ✓
- Less energy is needed to overcome intermolecular forces in HCℓ ✓

- *HF het waterstofbinding* ✓
- *HCℓ het dipool-dipoolkragte* ✓
- Dipool-dipoolkragte is swakker as die waterstofbinding ✓

Minder energie word benodig om die intermolekulêrekragte in HCℓ te oorkom ✓ (4)

[15]

QUESTION/*VRAAG* 4

4.1 Boyle's law ✓
The pressure of an enclosed gas is inversely proportional to the volume it occupies at constant temperature.✓✓

Boyle se wet ✓
Die druk van 'n ingeslote gas is omgekeerd eweredig aan die volume wat dit by konstante temperatuur beslaan. ✓✓ (3)

4.2

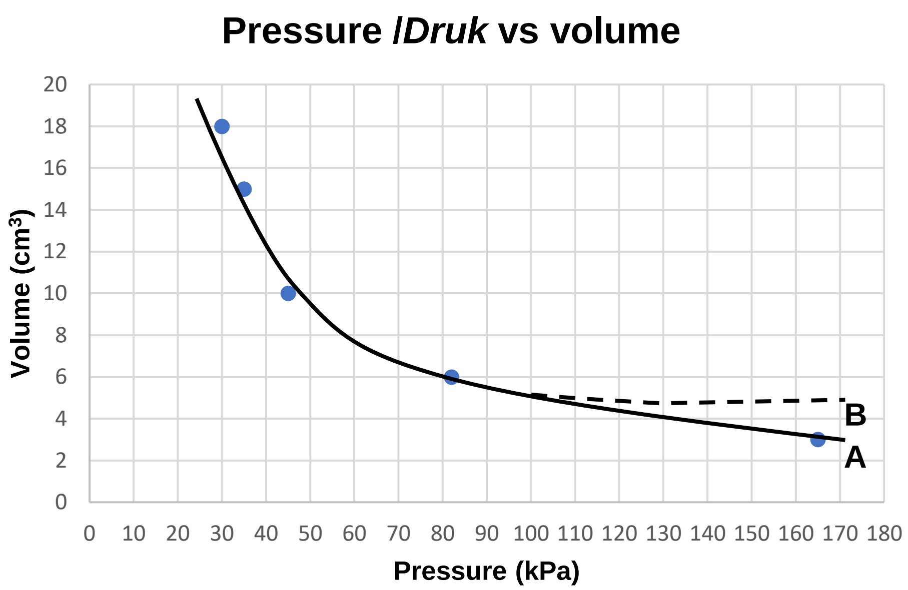
Criteria for hypothesis / *Nasienkriteria vir hipotese*
The independent and dependent variables are stated correctly ✓ *Die onafhanklike en afhanklike veranderlike korrek gestel* ✓
A Statement about the relationship between the independent and dependent variables ✓ *'n Stelling rondom die verwantskap tussen onafhanklike en afhanklike veranderlike* ✓

The higher the pressure of a gas the lower its volume ✓✓
Hoe hoër die druk van 'n gas hoe laer is sy volume ✓✓ (2)

4.3 40×10^3 Pa ✓ /4 KPa (1)

4.4 $p_1V_1 = p_2V_2$ ✓
$(40 \times 10^3)(12)$ ✓ $= (200 \times 10^3)V_2$ ✓
$V_2 = 2{,}4$ cm^3 ✓
(Use any correct co-ordinates from the graph / *Gebruik enige korrekte koördinate vanaf die grafiek*) (4)

4.5 **<u>Marking Criteria/ *Nasienkriteria*</u>**
Curve of **B** is higher than curve **A** at high pressure ✓✓
*Kurwe van **B** is hoër as die kurwe van **A** by hoë druk* ✓✓



(2)
[12]

QUESTION/*VRAAG* 5

5.1 The <u>minimum energy needed</u> to for a <u>reaction to take place</u>. ✓✓
Die <u>minimum energie</u> <u>wat benodig</u> word vir 'n <u>reaksie om plaas te vind</u>. ✓✓ (2)

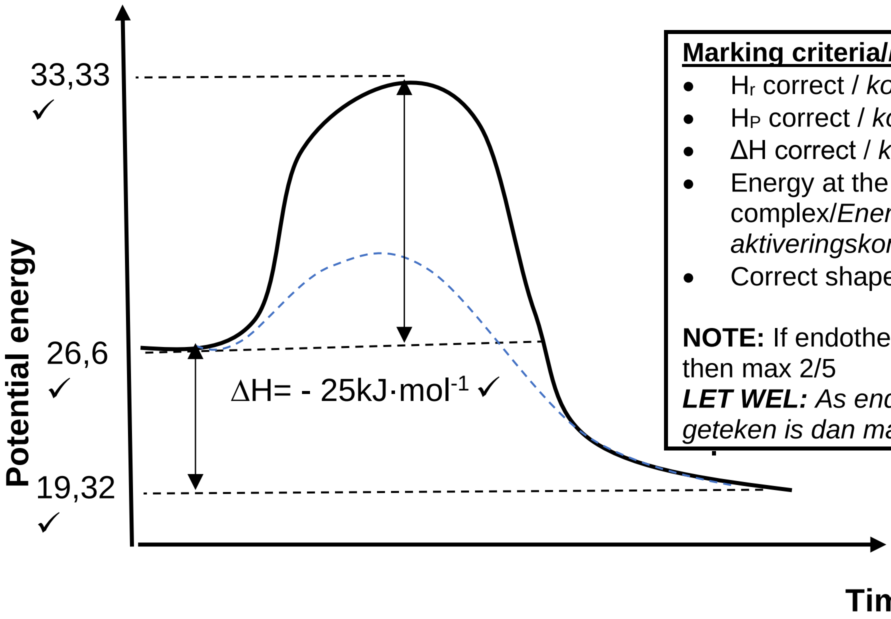
5.2 Exothermic / *Eksotermies*. ✓ $\Delta H < 0$ ✓ (2)

5.3 $\Delta H = H_p - H_r$

$-7{,}28 = H_p - 26{,}6$ ✓

$H_p = 19{,}32$ $kJ\cdot mol^{-1}$ ✓ (2)

5.4



Marking criteria/*Nasienkriteria*
- H_r correct / *korrek*
- H_P correct / *korrek*
- ΔH correct / *korrek*
- Energy at the activation complex/*Energie by aktiveringskompleks*
- Correct shape/ *Korrektevorm*

NOTE: If endothermic curve is drawn then max 2/5
LET WEL: *As endotermiese kurwe geteken is dan maks. 2/5*

(5)

5.5 **See sketch Question 5.4 / *Sien skets VRAAG 5.4***
Marking criteria / *Nasienkriteria*
- Curve start at the initial potential energy of reactants and end at the final potential energy of the products. / *Kurwe begin die aanvangs potensiële energie van die reaktanse en eindig by die finale potensiële energie van die produkte* ✓
- Curve peak is lower / *Kurwe piek is laer* ✓ (2)

[13]

QUESTION/*VRAAG* 6

6.1 6.1.1 The simplest whole number ratio of atoms in a compound. ✓✓
Die eenvoudigste heelgetal verhouding van atome in verbinding. ✓✓ (2)

6.1.2 P (58) + 13 (32) ✓ = 8 (44) + 10(18) ✓

P = 2 ✓ (3)

6.1.3 **OPTION 1: Using percentage composition/ *OPSIE 1: Gebruik die persentasie samestelling***

Mol C	:	Mol H
$\frac{82,76}{12}$ ✓	:	$\frac{17,24}{1}$ ✓
6,90	:	17,24
1	:	2,5
2	:	5 ✓

Marking criteria/*Nasienkriteria*
- % C divide by M (C)
% C gedeel deur M (C)
- % H divide by M (H)
% H gedeel deur M(H)
- Simplest mole ratio
Eenvoudigste molverhouding
- Ratio / *verhouding*
- Molecular formula
Molekulêre formule

Empirical formula / *Empiriese formule* : C_2H_5

Formula mass / *Formule massa* = 2 (12) + 1(5) = 29

Ratio / *Verhouding* = 58 / 29 = 2 ✓

Molecular formula / *Molekulêre formule* = C_4H_{10} ✓

OPTION 2: Using conservation of mass/ *OPSIE 2 : Gebruik die behoud van massa*

Number of carbon reactants / *Aantal koolstowwe in reakstanse* = Number of carbon products / *Aantal koolstowwe in produkte*
2 C = 8 C ✓

C = 4
Number of hydrogens reactants/ *Aantal waterstofatome in reakstanse* = Number of hydrogens products / *Aantal waterstofatome in produkte*
2 H = 10 H_2 ✓

H = (10)(2) / 2 ✓

H = 10

✓ Both / *Beide*

Molecular formula / *Molekulêre formule* = C_4H_{10} ✓ (5)

6.2 6.2.1 Limiting reagent is a reactant that is completely used up in a chemical reaction. ✓✓
Die beperkende reagens is die stof wat volledig opgebruik word tydens 'n chemiese reaksie. ✓✓ (2)

6.2.2

$$n = \frac{m}{M}$$ ✓

$$n = \frac{5}{106}$$ ✓

n = 0,047 mol
n (HCℓ) = 2(0,047) ✓
n (HCℓ) = 0,094 mol ✓ (4)

6.2.3 n (Na_2CO_3) = n (CO_2) = 0,047 mol ✓

$V = nV_m$ ✓

V = (0,047)(24,45) ✓

V = 1,149 dm^3 ✓ (4)

6.2.4

n (HCℓ) initial / *aanvangs* = 0,094 x 100 / 76 ✓= 0,124 mol	
$c = \frac{n}{V}$ ✓ $c = \frac{0,124}{0,1}$ ✓ $c = 1,24 \text{ mol·dm}^{-3}$ ✓	$c = \frac{n}{V}$ ✓ $c = \frac{0,124}{0,25}$ $c = 0,496 \text{ mol·dm}^{-3}$ $c_1V_1 = c_2V_2$ $(0,496)(250) = c_2(100)$ ✓ $c_2 = 1,24 \text{ mol·dm}^{-3}$ ✓

(4)
[24]

QUESTION/*VRAAG 7*

7.1 7.1.1 Au Acid is a substance that produces hydrogen ions (H^+)/ hydronium ions (H_3O^+) when it dissolves in water. ✓✓
'n Suur is 'n stof wat waterstofione (H^+)/ hidroniumione (H_3O^+) vorm wanneer dit in water oplos. ✓✓ (2)

7.1.2 H_2O ✓ and/ *en* HCO_3^- ✓ (2)

7.1.3 H_2CO_3 ✓and/ *en* H_3O^+ ✓ (2)

7.1.4 $H_2CO_3 + 2\ NaOH$ ✓ → $Na_2CO_3 + 2\ H_2O$ ✓ (✓ bal) (3)

7.2 7.2.1

OPTION 1/ *OPSIE 1*	**OPTION 2 / *OPSIE 2***
$c = \frac{m}{MV}$ ✓ $c = \frac{2}{(40)(0,1)}$ ✓ $c = 0,5 \text{ mol· dm}^{-3}$ ✓	$n = \frac{m}{M}$ $n = \frac{2}{40}$ $n = 0,05$ $c = \frac{n}{V}$ ✓ $c = \frac{0,05}{0,1}$ ✓ $c = 0,5 \text{ mol·dm}^{-3}$ ✓

(3)

7.2.2

OPTION 1 / *OPSIE 1*	**OPTION 1 / *OPSIE 1***
$NaOH \rightarrow Na^+ + OH^-$ $[NaOH] = [OH^-]$ $[OH^-] = 0,5\ mol \cdot dm^{-3}$ $[OH^-][H_3O^+] = 1 \times 10^{-14}$ $[H_3O^+](0,5) = 1 \times 10^{-14}$ ✓ $[H_3O^+] = 2 \times 10^{-14}\ mol \cdot dm^{-3}$ pH = - log[H_3O^+] ✓ = - log (2×10^{-14}) ✓ = 13,70 ✓	pOH = -= log [OH^-] pOH = -log(0,5) ✓ pOH = 0,30 pH +pOH = 14 ✓ pH + 0,30 = 14 ✓ pH = 13,70 ✓

(4)

7.3 7.3.1

$n = \frac{N}{N_A}$ ✓

$= \frac{9,033 \times 10^{22}}{6,02 \times 10^{23}}$ ✓

n = 0,15 mol ✓ (3)

7.3.2 **Positive marking from QUESTION 7.3.1/ *Positiewe nasien vanaf VRAAG 7.3.1***

Marking criteria / *Nasienkriteria*

- Formula / Formule c = n/V
- Subst. of NaOH values into / *Vervang waardes van NaOH in* n = cV
- **Using** mol ratio/ ***Gebruik** die molverhouding* HCℓ : NaOH = 1 : 1
- Determine the mol of HCℓ in reaction 1 / *Bepaal die mol HCℓ in reaksie 1*
- **Using** ratio / ***Gebruik** die molverhouding* HCℓ : $MgCO_3$ = 2 : 1
- Subst. into / *Vervang in* m = nM
- Subst. into percentage formula / *Vervang in persentasie formule*
- Final answer / *Finale antwoord*

n (NaOH) = cV ✓

n (NaOH = $0,8 \times \frac{55}{1\ 000}$ ✓

n = 0,044 mol

NaOH : HCℓ

1 : 1

n(HCℓ) excess = 0,044 mol ✓

n(HCℓ) reaction 1 = n(HCℓ) initial – n(HCℓ) excess

= 0,15 – 0,044 ✓

= 0,106 mol

HCℓ : $MgCO_3$
2 : 1
0,106 : n($MgCO_3$) = 0,053 mol ✓

m = nM
= 0,053 x 84 ✓
= 4,452 g

% purity = $\frac{\text{pure mass}}{\text{Sample mass}}$ x 100%
= $\frac{4,452}{5}$ x 100 % ✓
= 89,04 % ✓ (8)

[27]

QUESTION/*VRAAG 8*

8.1 8.1.1 A redox is a reaction that involves an electron transfer. ✓✓
ŉ Redoksreaksie is ŉ reaksie wat ŉ elektronoordrag behels. ✓✓

OR / *OF*

It is a reaction that always involve changes in oxidation numbers. ✓✓
Dit is ŉ reaskie wat altyd ŉ verandering in oksidasiegetalle behels. ✓✓ (2)

8.1.2 Ni^{2+} ✓

Oxidation number <u>decreases from +2 to 0</u>. ✓✓
Die oksidasiegetal <u>neem af vanaf +2 na 0</u>. ✓✓ (3)

8.1.3 Nitrate ion (NO_3^-) is spectator ion / undergoes no changes in its oxidation state. ✓
Nitraatioon (NO_3^-) is ŉ toeskouerioon/ ondergaan geen verandering in sy oksidasiegetal (1)

8.2 8.2.1 $Cr_2O_7^{2-}$
2x + 7(-2) = -2 ✓
x = +6 ✓ (2)

8.2.2 $Cr_2O_7^{2-} + 14\ H^+ + 6e^- \rightarrow 2\ Cr^{3+} + 7\ H_2O$ ✓✓ (2)

8.2.3 $Sn^{2+} \rightarrow Sn^{4+} + 2e^-$ ✓
$Cr_2O_7^{2-} + 14\ H^+ + 6e^- \rightarrow 2\ Cr^{3+} + 7\ H_2O$
$3\ Sn^{2+} + Cr_2O_7^{2-} + 14\ H^+$ ✓$\rightarrow 3Sn^{4+} + 2\ Cr^{3+} + 7\ H_2O$ ✓ (✓ bal) (4)

[14]

TOTAL/*TOTAAL:* 150