LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF
EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE/*GRAAD* 11

PHYSICAL SCIENCES: CONTROLLED TEST 2

FISIESE WETENSKAPPE: KONTROLE TOETS 2

AMENDED MARKING GUIDELINE/*AANGEPASTE NASIENRIGLYNE*

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MARKS/PUNTE: 100

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

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QUESTION 1/*VRAAG 1*

1.1 C ✓✓ (2)

1.2 D ✓✓ (2)

1.3 C ✓✓ (2)

1.4 D ✓✓ (2)

1.5 B ✓✓ (2)

[10]

QUESTION 2/*VRAAG 2*

2.1 The minimum energy needed for a reaction to take place. ✓✓/ *Die minimum energie wat benodig word vir 'n reaksie om plaas te vind*

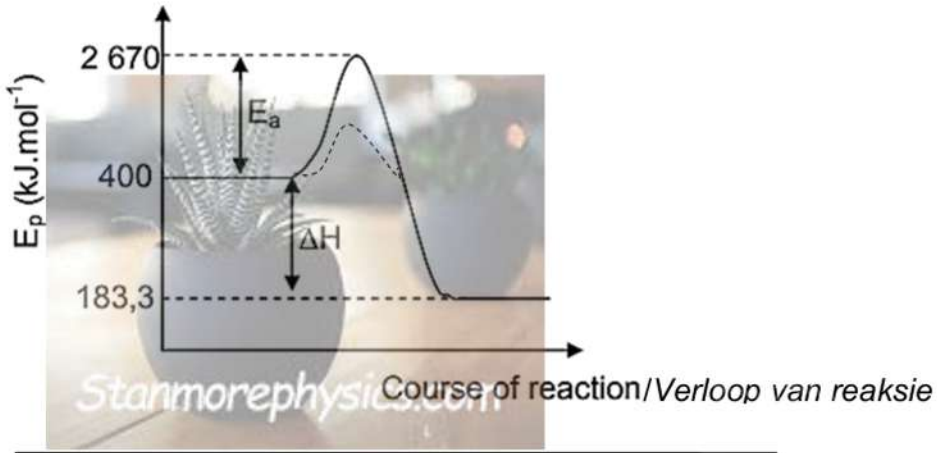
- **Accept** More energy is released than absorbed.✓✓
- ***Aanvaar*** *Meer energie word vrygestel as geabsorbeer*

(2)

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2.2 The potential energy of the product is lower than that of the reactants. ✓/ *Die potensiële energie van die produk is laer as dié van die reaktante.* (1)

2.3



Marking criteria/*Nasienriglyne*

- A dotted line under the activated complex✓/ *'n Stippellyn onder die geaktiveerde kompleks*

(1)

2.4

2.4.1 183,3 kJ.mol^{-1} ✓ (1)

2.4.2 400 kJ.mol^{-1} ✓ (1)

2.4.3 2487.6 kJ.mol^{-1} ✓ (1)

2.4.4 2 670 kJ.mol^{-1} ✓ (1)

2.5 ΔH = Energy of products − Energy of reactants/ *ΔH = Energie van produkte – energie van reaktante*

= 400 - 183.3 ✓

= 216.7 kJ.mol^{-1} ✓ (2)

2.6

2.6.1 REMAIN THE SAME ✓/*BLY DIESELFDE* (1)

2.6.2 REMAIN THE SAME ✓/*BLY DIESELFDE* (1)

2.6.3 DECREASE ✓/*NEEM AF* (1)

[13]

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QUESTION 3/*VRAAG 3*

3.1

3.1.1 A base is a substance that produces hydroxide ions (OH^-) when it dissolves in water. ✓✓/ *'n Basis is 'n stof wat hidroksiedione (OH^-) produseer wanneer dit in water oplos.* (2)

3.1.2 HNO_3 (aq) ✓+ $H_2O(\ell)$ ✓→ $H_3O^+(aq) + NO_3^-(aq)$✓ (3)

Notes/*notas:*
- Reactants ✓✓/*reaktante*
- Products ✓/*produkte*
- Ignore phases/*ignoreer fases*
- Ignore double arrows/*ignoreer dubbel pyle*

3.1.3 Water ✓✓ (2)

3.2 Water/$H_2O(\ell)$ identifies as a base in the reaction because it accepts a Hydrogen ion/proton/H^+ from Hydrochloric acid $HC\ell(aq)$ to form $H_3O^+(aq)$.✓✓/ *Water/H2O(ℓ) identifiseer as 'n basis in die reaksie omdat dit 'n waterstofioon/proton/H^+ van soutsuur $HC\ell(aq)$ aanvaar om $H3O^+(aq)$ te vorm.* (2)

3.3 An acid-base indicator is a weak acid, or a weak base, which colour changes as the H^+ ion concentration or the OH^- ion concentration in a solution changes. ✓✓/ *'n Suur-basis-indikator is 'n swak suur, of 'n swak basis, waarvan die kleur verander soos die H^+-ioonkonsentrasie of die OH^--ioonkonsentrasie in 'n oplossing verander.* (2)

3.4 $HC\ell(aq)$✓+ KOH(aq) ✓→ $KC\ell$ (s) + $H_2O(\ell)$✓ (3)

Notes/*notas:*
- Reactants ✓✓/*reaktante*
- Products ✓/*produkte*
- Ignore phases/*igoneer fases*
- Ignore double arrows/*ignoreer dubbel pyle*

[14]

QUESTION 4/*VRAAG 4*

4.1 A reagent that gets used up completely in a chemical reaction✓✓/ *'n Reagens wat volledig in 'n chemiese reaksie opgebruik word* (2)

4.2 $CaCO_3(s) + H_2SO_4(aq)$ ✓→ $CaSO_4(aq) + H_2O(\ell) + CO_2(g)$✓ Bal✓ (3)

Notes/Notas:

- Reactants✓ /*reaktante* Products ✓/*produkte* Balancing ✓/*balansering*
- Ignore phases/*ignoreer fases*
- Ignore double arrows/*ignoreer dubbel pyle*

4.3

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$C(CaCO_3) = \frac{m}{MV}$ ✓ $= \frac{20}{(100)(0,5)}$ ✓ $= 0.4\ mol.dm^{-3}$✓	$n(CaCO_3) = \frac{m}{M}$ ✓ $= \frac{20}{(100)}$ $=0.2\ mol.dm^{-3}$✓ $C(CaCO3) = \frac{n}{V}$ $= \frac{0.2}{0.5}$ ✓ $= 0.4\ mol.dm^{-3}$✓

(4)

4.4 **POSITIVE MARKING FROM 4.3/*POSITIEWE NASIEN VANAF 4.3***

OPTION 1/OPSIE 1	**OPTION 2/*OPSIE 2***
$0.2mol\ n(CaCO_3) \times \frac{0.1mol\ H_2O}{0.2mol\ (CaCO3)}$ $= 0.1\ mol\ H_2O$ produced by $CaCO_3$ ✓ $n(H_2SO_4) = CV$ $= (0.25)(0.5)$ ✓ $= 0.125\ mol$	$n(CaCO_3) = \frac{m}{M}$ ✓ $= \frac{20}{(100)}$ $=0.2\ mol.dm^{-3}$✓ $n(H_2SO_4) = CV$ $= (0.25)(0.5)$ ✓ $= 0.125\ mol$

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$0.125\text{mol}\ (H_2SO_4) \times \frac{0.1\text{mol}\ H_2O}{0.125\text{mol}\ (H_2SO_4)}$ = 0.1 mol H_2O produced by H_2SO_4 ✓ Ratio/*Verhouding* $CaCO_3 : H_2SO_4$ 1:1 0.2mol : 0.125 mol Since you will need 1mol of CaCO3 to react with 1mol H2SO4, to produce 0.1mol H_2O. H2SO4 is less and it will run out first./ *Aangesien jy 1 mol $CaCO_3$ benodig om met 1 mol H_2SO_4 te reageer om 0.1 mol H_2O te produseer, is H_2SO_4 minder en dit sal eerste opraak.* H_2SO_4 is a limiting agent ✓ / *H_2SO_4 is 'n beperkende middel*	Ratio/*verhouding* $CaCO_3 : H_2SO_4$ 1:1 0.2 mol : 0.125 mol Since you will need 1mol of $CaCO_3$ to react with 1mol H_2SO_4, to produce 0.1mol H_2O. H_2SO_4 is less and it will run out first. ./ *Aangesien jy 1 mol $CaCO_3$ benodig om met 1 mol H_2SO_4 te reageer om 0.1 mol H_2O te produseer, is H_2SO_4 minder en dit sal eerste opraak.* H_2SO_4 is a limiting agent ✓ / *H_2SO_4 is 'n beperkende middel*

(4)

4.5 **POSITIVE MARKING FROM 4.3 and 4.4/*POSITIEWE NASIEN VANAF 4.3 EN 4.4***

Mol ratio 1:1 only 0.125 mol $CaCO_3$ can react./ *Molverhouding 1:1, slegs 0.125 mol $CaCO_3$ kan reageer.*

$CaCO_3 : H_2SO_4$
1 : 1 ✓
0.2 mol : 0.125
n($CaCO_3$) reacted = 0.125 mol ✓
m($CaCO_3$) reacted = nm
= (0.125) (100) ✓
= 12,5g

% Purity = $\frac{\text{Pure substance}}{\text{Impure substance}}$ /% $Suiwerheid = \frac{suiwer\ stof}{onsuiwer\ stof}$

$= \frac{12.5}{20} \times 100$ ✓
= 62.5 %✓

(5)
[18]

QUESTION 5/*VRAAG 5*

5.1 The mass of one mole of a substance measured in g·mol⁻¹.✓✓/ *Die massa van een mol van 'n stof gemeet in g·mol⁻¹* (2)

5.2

5.2.1 M (H_2O) = 1(2) + 16✓

= 18 g.mol⁻¹✓ (2)

5.2.2 Percentage composition in mass/ *Persentasie samestelling in massa*

Element	Percentage composition in mass/ *Persentasie samestelling in massa*	$n = \frac{m}{M}$	Divide all mole values with 0.709/ *Deel alle molwaardes met 0.709*
C	76%	76/12 = 6.383✓	6.383/0.709 = 9✓
H	12.05%	12.05/1 = 12.05✓	12.05/0/709 = 17✓
O	11.35%	11,35/16 = 0.709 ✓	= 0.709/0.709 = 1✓

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The empirical formula is/*Die empiriese formule is*: **$C_9H_{17}O$**✓

(7)

5.3 Calculate the number of moles of carbon dioxide produced/ *Bereken die aantal mol koolstofdioksied wat geproduseer word*

$n = \frac{m}{M}$✓

$= \frac{0.01863}{44}$✓

= 0.0004 mol✓ (3)

[14]

QUESTION 6/*VRAAG 6*

6.1 An acid is a proton donor. ✓✓ / *'n Suur is 'n proton skenker.* **(2 or/*of* 0)** (2)

6.2 Acidic✓/*suur*
Hydronium ions are formed in water.✓/ *Hidroniumione word in water gevorm.* (2)

6.3 H_2O✓✓ (2)

6.4
6.4.1 Neutralisation/acid-base ✓✓ / *Neutralisasie/suur-basis* (2)

6.4.2 $H_2SO_4(aq) + 2KOH(aq)$ ✓ → $K_2SO_4(aq) + 2H_2O(\ell)$ ✓ Bal. ✓ (3)

Notes / *Aantekeninge:*
- Reactants / *Reaktante* ✓
  Products / *Produkte* ✓
  Balancing / *Balanssering* ✓
- Ignore phases / *Ignoreer fases*
- Ignore double arrows / *Ignoreer dubbel pyltjies*
- Marking rule 6.3.10 / *Merk reel 6.3.10*

6.4.3 Blue to yellow✓✓ / Blou na geel (2)

6.4.4 It's a reaction between strong acid and strong base /neutralisation occurs at almost pH = 7 ✓ / *Dit is 'n reaksie tussen 'n sterk suur en 'n sterk basis / neutralisasie vind plaas by amper pH = 7.* (1)

[14]

QUESTION 7/*VRAAG 7*

7.1 The 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 by konstante temperatuur beslaan* (2)

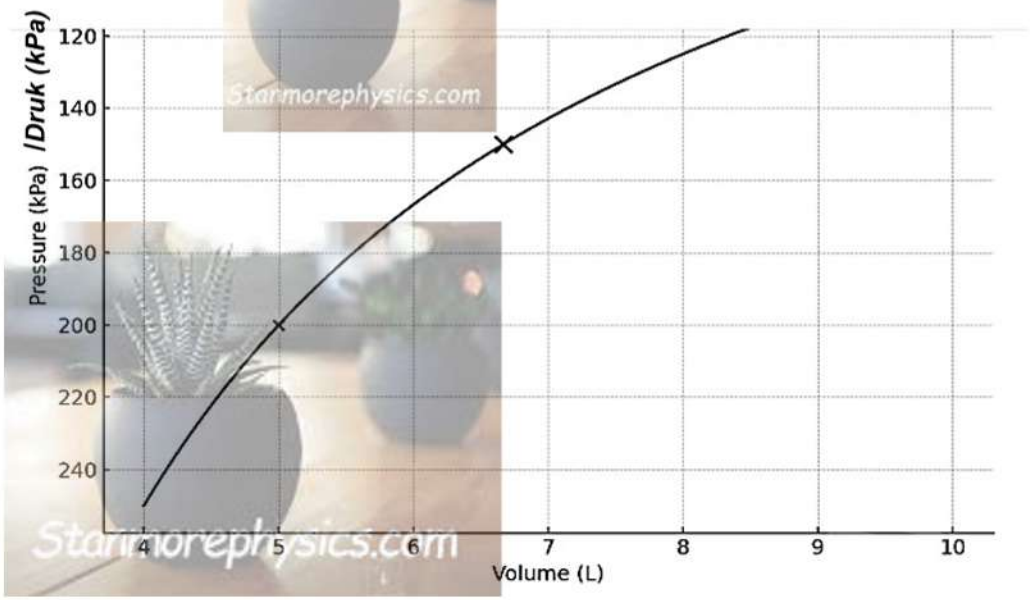
7.2

7.2.1 $P_1V_1 = P_2V_2$ ✓

(200) (5.0) ✓= (150) V_2 ✓

$V_2 = 6{,}67L$ ✓ (4)

7.2.2 **Pressure vs volume for an ideal gas at constant temperature./ *Druk teenoor volume vir 'n ideale gas by konstante temperatuur***



Notes/*Notas*

- X and Y axis labelled ✓/*X en Y as byskrifte*
- Curved line✓/*geboë lyn*
  Initial volume on graph/ *Aanvanklike volume op grafiek*
- Point marked x on graph (200:5)✓/ *Punt gemerk met x op grafiek (200:5)*
  Final volume on graph/*Finale volume op grafiek*
- Point marked x on graph (140 -160: 6-7)✓(Any reasonable range point)
  Punt gemerk x op grafiek (140 -160: 6-7) (Enige punt met redelike bereik)

(4)

7.3 $n = \frac{V}{V_m}$ ✓

$= \frac{11,2}{22,4}$ ✓

= 0,5 mol

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

0,5 = 16✓ / M

=32,0 g. mol⁻¹ ✓

Molar mass of approximately 32,0 g. mol⁻¹ correspond to that of O_2/Oxygen ✓ / *Molêre massa van ongeveer 32,0 g. mol⁻¹ stem ooreen met dié van* O_2*/suurstof* (5)

7.4 The pressure doubles✓ because the same number of molecules are now confined to a smaller volume, leading to more frequent collisions with the tire.✓/ *Die druk verdubbel omdat dieselfde aantal molekules nou tot 'n kleiner volume beperk is, wat lei tot meer gereelde botsings met die band.* (2)

[17]

TOTAL/*TOTAAL* **[100]**