KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11

PHYSICAL SCIENCES

SEPTEMBER 2025

MARKING GUIDELINES

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MARKS: 100

These marking guidelines consist of 8 pages.
Hierdie nasienriglyne bestaan uit 8 bladsye.

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QUESTION 1/*VRAAG 1*

1.1 C ✓✓ (2)

1.2 A ✓✓ (2)

1.3 A ✓✓ (2)

1.4 REMOVE, mark question 1 out of 12, and convert to 14 using table below.

1.5 C ✓✓ (2)

1.6 A ✓✓ (2)

1.7 B ✓✓ (2)

[2 x 7 = 14]

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CONVERSION TABLE

Mark obtained	Converted mark
0	0
2	2
4	5
6	7
8	9
10	12
12	14

QUESTION 2/*VRAAG 2*

2.1.1 Limiting reagent is the reactant that is consumed completely in a reaction. ✓✓
OR the substance that determines the amount of products formed. (2 or 0)
Beperkte reagens is die reagens wat volledig opgebruik word in a reaksie. (2)

NOTE: QUESTIONS 2.1.2 & 2.1.3 may be answered in a single table. Award marks accordingly

2.1.2

$n = \frac{m}{M}$	$n = \frac{V}{V_m}$
$n = \frac{34,5}{16}$ ✓	$n = \frac{69,3}{22,4}$ ✓
$n = 2,16$ mol CH_4	$n = 3,09$ mol O_2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***	**OPTION 3/*OPSIE 3***
$CH_4 : O_2$ 1 : 2 2,16 : 4,32 mol ✓	$CH_4 : O_2$ 1 : 2 1,55 : 3,09 mol ✓	3,09 ÷2 < 2,16 ÷ 1 ✓

O_2 is used up completely/ O_2 is the limiting reagent. ✓ (4)

2.1.3 **POSITIVE MARKING FROM QUESTION 2.1.2**
POSITIEWE NASIEN VANAF VRAAG 2.1.2

Marking criteria/Nasienriglyne
- Calculate number of moles CO_2 formed./*Bereken aantal mol CO_2 gevorm.*
- Calculate number of moles CH_4 left unreacted./*Bereken aantal mol CH_4 wat nie reageer het nie.*
- Addition of two different gases./*Bymekaartel van twee verskillende gasse.*
- Correct answer./*Korrekte antwoord.* Range: 2,156 – 2,160

OPTION 1/*OPSIE 1*		**OPTION 2/*OPSIE 2***
$O_2 : CO_2$ 2 : 1 3,09 :1,55 mol ✓	**OR**	$CH_4 : CO_2$ 1 : 1 1,55 : 1,55 mol ✓

Amount of CH_4 left over = 2,16 – 1,55 ✓
= 0,61 mol

Total number of moles of gas = 0,61 + 1,55 ✓
= 2,16 mol ✓ (4)

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2.1.4 **POSITIVE MARKING FROM QUESTION 2.1.2**
POSITIEWE NASIEN VANAF VRAAG 2.1.2

OPTION 1/*OPSIE 1*	**OPTION 2/*OPSIE 2***
$n = \frac{m}{M}$ $1,55 = \frac{m}{44}$ ✓ m = 68,2 g % yield = $\frac{\text{Actual yield}}{\text{Theoretical yield}}$ x 100 ✓ = $\frac{58,05}{68,2}$ x 100 ✓ = 85,11 % ✓	$n = \frac{m}{M}$ = $\frac{58,08}{44}$ ✓ = 1,32 mol % yield = $\frac{\text{Actual yield}}{\text{Theoretical yield}}$ x 100 ✓ = $\frac{1,32}{1,55}$ x 100 ✓ = 85,16 % ✓

(4)

2.2.1 The amount of solute/dissolved substance/mole per litre/dm^3 of solution. ✓✓
The hoeveelheid opgeloste stof/mol per liter/dm^3 van die oplossing. (2)

2.2.2

OPTION 1/*OPSIE 1*

$c = \frac{m}{MV}$ ✓

$c = \frac{(105,6)}{(164)(0,2)}$ ✓

$c = 3,22\ mol{\cdot}dm^{-3}$ ✓.

OPTION 2/*OPSIE 2*

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

$n = \frac{105,6}{164}$ ✓

n = 0,64 moles

$c = \frac{n}{V}$ ✓

= $\frac{0,64}{0,2}$ ✓

= $3,2\ mol{\cdot}dm^{-3}$ ✓ (4)

2.2.3 **CRITERIA:**

- Substitution into formula
- Apply ratio (2:1)
- Final answer

$n = \frac{N}{N_A}$

(0,64 x 2) ✓= $\frac{N}{6,02 \times 10^{23}}$ ✓

$N = 7,71\ X\ 10^{23}$ ✓

OR/*OF* $n = \frac{N}{N_A}$

$0,64 = \frac{N}{6,02 \times 10^{23}}$ ✓

$N = 3,85 \times 10^{23}\ Ca(NO_3)_2$

Number of NO_3^- ions = 2 x ($3,85 \times 10^{23}$) ✓

= $7,71\ X\ 10^{23}$ ✓ (3)

2.2.4 Decreases. ✓
(Net) absorption of energy.✓
Energy of surrounding/solution/water decreases. ✓ (3)

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2.3.1

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

$n = \frac{11,62}{12}$ ✓ | $n = \frac{1,94}{1}$ ✓ | $n = \frac{15,49}{16}$ ✓

= 0,97 mole C | = 1,94 mole H | = 0,97 mole O

C : H : O

0,97 : 1,94 : 0,97 ✓ (If this ratio is not shown, award 2 marks for answer)

1 : 2 : 1

CH_2O ✓ (5)

2.3.2. M_r (CH_2O) = 30 g·mol^{-1}

$\frac{90}{30} = 3$ ✓

Molecular formula = $C_3H_6O_3$ ✓ (2)

[32]

QUESTION 3/*VRAAG 3*

3.1 Exothermic. ✓
There is a net release of energy/More energy is released than absorbed./
$\Delta H < 0$/ΔH is negative./Energy of products is less than energy of reactants.✓

Eksotermies ✓
Meer energie is vrygestel as geabsorbeer./$\Delta H < 0$/ΔH is negatief./Energie van reaktante is minder as energie van produkte. ✓ (2)

3.2

OPTION 1/*OPSIE 1*

$\Delta H = E_{products} - E_{reactants}$
$= 37 - 81$✓
$= -44$ kJ·mol^{-1} ✓

OPTION 2/*OPSIE 2*

$\Delta H = E_{absorbed} - E_{released}$
$= 34 - 78$✓
$= -44$ kJ·mol^{-1} ✓ (2)

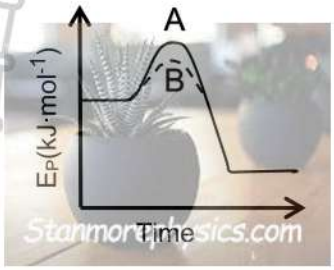
3.3 The minimum energy needed for a reaction to take place. ✓✓
OR The minimum energy required to break the bonds in the reactants.
Die minimum energie benodig vir die reaksie om plaas te vind. (2)

3.4 $E_A = 78$ kJ·mol^{-1} ✓ (1)

3.5 Weaker than.✓ $A_2 + B_2$.
More energy is released when the bonds in the products are formed than when the bonds in the reactants are broken.✓✓
OR
The products are more stable than the reactants because they have less energy than that of the reactants.
OR
The activation energy for the forward reaction is less than the activation energy for the reverse reaction. (3)

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3.6



Marking criteria/*Nasien riglyne*
- E_A with catalyst is less than E_A without./E_A met katalisator is minder as E_A sonder. ✓
- Energy of reactants and products remain the same./Energie van reaktante en produkte bly dieselfde. ✓

(2)
[12]

QUESTION 4/*VRAAG 4*

4.1.1 A acid is proton donor✓ ✓
'n Suur is 'n protonontskenker. (2)

4.1.2 H_2O ✓ and/*en* NO_3^- ✓ (2)

4.1.3 *Strong* ✓ It ionizes completely to produce a high concentration of H_3O^+ ions ✓
Sterk. Dit ioniseer volledig. (2)

4.1.4 A substance that can act as an acid in one reaction and a base in another reaction ✓✓ (2 OR 0) (2)

4.1.5 H_2O ✓ (1)

4.2.1 A solution of known concentration./
'n Oplossing met bekende konsentrasie. ✓✓ (2 or 0) (2)

4.2.2

OPTION 1/*OPSIE 1*

$$\frac{C_A V_A}{C_B V_B} = \frac{n_A}{n_B} \checkmark$$

$$\frac{C_A (21{,}08)}{(0{,}1)(25)} \checkmark = \frac{1}{2} \checkmark$$

$C_A = 0{,}06$ mol·dm^{-3} ✓

OPTION 2/*OPSIE 2*

$c = \frac{n}{V}$ ✓ either formula

$0{,}1 = \frac{n}{0{,}025}$ ✓

n = 0,0025 mol

KOH : H_2SO_4
2 : 1
0,025 : 0,00125 mol H_2SO_4

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

$c = \frac{0{,}00125}{0{,}0211}$ ✓

n = 0,06 mol·dm^{-3} ✓

(5)

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4.2.3 Bromothymol blue/*Broomtimolblou*✓
Bromothymol blue changes colour in the range of the endpoint of the titration✓
OR A strong acid is reacting with a strong base.
Broomtimolblou verander kleur in die gebied van die eindpunt. (2)

4.3

Marking criteria/*Nasienriglyne*

- Calculate the initial mol of $Ca(OH)_2$./*Bereken aantal mol $Ca(OH)_2$ gebruik.* ✓
- Calculate the initial mol of HCl./*Bereken aantal mol HCl gebruik.* ✓
- Correctly apply the ratio of $Ca(OH)_2$: HCl (2 : 1). ✓
- Calculate correct amount of HCl unreacted./*Bereken hoeveelheid mol HCl wat nie reageer het nie.* ✓
- Correct substitution to calculate concentration of HCl after titration./*Korrekte invervanging om konsentrasie HCl te bepaal na titrasie.* ✓
- Correct formula for pH./*Korrekte formule vir pH.* ✓
- Correct substitution to calculate pH./ *Korrekte invervanging om pH te bereken.* ✓
- *Correct answer/Korrekte antwoord* ✓

$C_B = \frac{n}{V}$

$0,1 = \frac{n}{0,02}$ ✓

$n = 2 \times 10^{-3}$ mol $Ca(OH)_2$

$C_A = \frac{n}{V}$

$0,15 = \frac{n}{0,03}$ ✓

$n = 4,5 \times 10^{-3}$ mol HCl

Amount of HCl needed to neutralise $Ca(OH)_2$:

$Ca(OH)_2$: HCl

$2 \times 10^{-3} : 4 \times 10^{-3}$ mol HCl ✓

Amount of HCl left unreacted= $4,5 \times 10^{-3} - 4 \times 10^{-3}$ ✓

$= 5 \times 10^{-4}$ mol

$C = \frac{n}{V}$

$C = \frac{5 \times 10^{-4}}{0,05}$ ✓ $= 0,01$ mol·dm^{-3}

$[H_3O^+] = [HCl] = 0,01$ mol·dm^{-3}

$pH = -\log[H_3O^+]$ ✓

$= -\log(0,01)$ ✓

$= 2$ ✓

(8)
[25]

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QUESTION 5/*VRAAG 5*

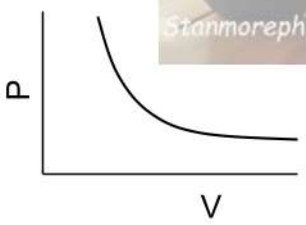
5.1.1 The pressure exerted by a fixed amount / constant mass of gas is inversely proportional to its volume, provided the temperature remains constant.✓✓
OR
The volume occupied by a fixed amount / constant mass of gas is inversely proportional to its pressure, provided the temperature remains constant.✓✓ (2)

Die druk van 'n vaste hoeveelheid gas is omgekeerd eweredig aan die volume daarvan, mits die temperatuur konstant bly.

5.1.2 When the valve is opened, volume increases./*Wanneer die klep oop gedraai word vergroot die volume.* ✓
According to Boyle's Law, as volume increases, pressure decreases✓./*Volgens Boyle se Wet sal die druk afneem indien die volume toeneem.* (2)

5.1.3 $p_1V_1 = p_2V_2$ ✓
$(135,2)(5,3)$ ✓ $= p_2(8,5)$ ✓
$p_2 = 84,30$ kPa ✓ (4)

5.2



Marking criteria/*Nasien riglyne*
Correct shape./*Korrekte vorm.* ✓✓ (2)

5.3 Low pressure ✓ and high temperatures. ✓/*Lae druk en hoë temperature.* (2)

5.4 Helium ✓
Helium has the smallest volume/molecular mass,✓ with no forces of attraction between molecules.✓/*Helium het die kleinste volume/molekulêre massa.*
Ideal gas molecules do not contribute to the volume of the gas.✓
/*Ideale gasse se volume dra nie by tot die volume van die houer nie.* (4)

[16]

TOTAL/*TOTAAL*: 100

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