



education

DEPARTMENT: EDUCATION
MPUMALANGA PROVINCE

GERT SIBANDE DISTRICT

GRADE 11

PHYSICAL SCIENCES TOPIC TEST

**TOPIC: QUANTITATIVE ASPECTS OF CHEMICAL CHANGE
AUGUST 2023
MARKING GUIDELINES**

MARKS: 50

These marking guidelines consist of 5 pages

QUESTION 1

1.1 B ✓✓

(2)

1.2 C ✓✓

(2)

1.3 D ✓✓

(2)

[6]**QUESTION 2**

2.1

Marking criteria: - Substitute $44 \text{ g} \cdot \text{mol}^{-1}$. ✓ - Substitution $12 \text{ g} \cdot \text{mol}^{-1}$. ✓ - Final answer $7,68 \text{ g}$ ✓	OPTION 1 $m(\text{C}) = \frac{12}{44} \times 28,16$ $\therefore m(\text{C}) = 7,68 \text{ g}$
OPTION 2 $n = \frac{m}{M}$ $\therefore n(\text{CO}_2) = \frac{28,16}{44} = 0,64 \text{ mol}$ $n(\text{C}) = n(\text{CO}_2) = 0,64 \text{ mol}$ $m(\text{C}) = nM$ $= (0,64)(12)$ $= 7,68 \text{ g}$	OPTION 3 $\% \text{C in CO}_2 = \frac{12}{44} \times 100$ $= 27,27\%$ $m(\text{C}) \text{ in CO}_2 = 27,27\% \text{ of } 28,16 \text{ g}$ $m(\text{C}) = 7,68 \text{ g}$

(3)

2.2 **POSITIVE MARKING FROM Q 2.1**

Marking criteria: - Substitute $M(\text{H}_2\text{O})$ to calculate $n(\text{H}_2\text{O})$. ✓ $n(\text{H}) = 2n(\text{H}_2\text{O})$. ✓ - Substitution $M(\text{H})$ to calculate $m(\text{H})$. ✓ $m(\text{O}) = m(\text{menthol}) - (m(\text{C}) + m(\text{H}))$. ✓ - Substitution $M(\text{O})$ to calculate $n(\text{O})$. ✓ - Ratio: $\text{mol C} : \text{mol H} : \text{mol O} = 10 : 20 : 1$. ✓ - Empirical formula: $\text{C}_{10}\text{H}_{20}\text{O}$. ✓
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OPTION 1

n(H) and m(H)

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

$$\therefore n(\text{H}_2\text{O}) = \frac{11,52}{18} \checkmark$$

$$= 0,64 \text{ mol}$$

$$n(\text{H}) = 2n(\text{H}_2\text{O})$$

$$= 2(0,64) \checkmark$$

$$= 1,28 \text{ mol}$$

$$m(\text{H}) = nM$$

$$= (1,28)(1) \checkmark$$

$$= 1,28 \text{ g}$$

n(O) and m(O)

$$m(\text{O}) = 9,984 - (7,68 + 1,28) \checkmark$$

$$= 1,024 \text{ g}$$

$$n(\text{O}) = \frac{1,024}{16} \checkmark$$

$$= 0,064 \text{ mol}$$

Ratio:

mol C : mol H : mol O

$$0,64 : 1,28 : 0,064$$

$$10 : 20 : 1 \checkmark$$

Empirical formula: $\text{C}_{10}\text{H}_{20}\text{O} \checkmark$

OPTION 2

$$\% \text{H in H}_2\text{O} = \frac{2 \checkmark}{18 \checkmark} \times 100$$

$$= 11,11\%$$

$$m(\text{H}) \text{ in H}_2\text{O} = 11,11\% \text{ of } 11,52 \text{ g} \checkmark$$

$$= 1,28 \text{ g}$$

$$m(\text{O}) = 9,984 - (7,68 + 1,28)$$

$$= 1,024 \text{ g} \checkmark$$

C	:	H	:	O
7,68	:	1,28	:	1,024
12	:	1	:	16 \checkmark

$$0,64 : 1,28 : 0,064$$

$$10 : 20 : 1 \checkmark$$

Empirical Formula: $\text{C}_{10}\text{H}_{20}\text{O} \checkmark$

(7)

2.3 POSITIVE MARKING FROM Q 2.2

OPTION 1

$$M(\text{C}_{10}\text{H}_{20}\text{O}) = 10 \times 12 + 20 + 16 = 156 \text{ g} \cdot \text{mol}^{-1} \checkmark$$

$$\text{Molecular formula: } \text{C}_{10}\text{H}_{20}\text{O} \checkmark$$

OPTION 2

$$(\text{C}_{10}\text{H}_{20}\text{O})_x = 156$$

$$(12 \times 10 + 20 + 16)_x = 156$$

$$156x = 156$$

$$x = 1 \checkmark$$

$$\text{Molecular formula} = \text{C}_{10}\text{H}_{20}\text{O} \checkmark$$

(2)
[12]

QUESTION 3

3.1 A reagent/substance that is completely used up in a chemical reaction. ✓✓
[2 or 0 MARK] (2)

3.2.1

$$\begin{aligned} n(\text{Fe}) &= \frac{m}{M} \\ &= \frac{20}{56} \checkmark \\ &= 0,357 \text{ mol Fe} \end{aligned}$$

$$\begin{aligned} n(\text{S}) &= \frac{m}{M} \\ &= \frac{10}{32} \checkmark \\ &= 0,313 \text{ mol} \end{aligned}$$

✓ Any formula

From balanced equation:

1 mol Fe reacts with 1 mol S / $n(\text{S}) < n(\text{Fe})$ ✓

(The limiting reactant is S.)

OR: Any other correct method used to determine the limiting reagent. (4)

3.2.2 POSITIVE MARKING FROM Q 3.2.1

$$n(\text{Fe used}) = \frac{m}{M} \checkmark$$

$$0,313 = \frac{m}{56} \checkmark$$

$$\therefore m(\text{Fe used}) = 17,53 \text{ g}$$

$$m(\text{excess}) = 20 - 17,53 \checkmark = 2,47 \text{ g} \checkmark$$

(4)

3.3.1 $n(\text{HBr}) = CV$ ✓

$$n(\text{HBr}) = 0,125 \times 0,014 \checkmark = 0,0018 \text{ mol}$$

$$n(\text{HBr}): n(\text{BaBr}_2) = 2:1$$

$$n(\text{BaBr}_2) = 0,0018 \div 2 = 0,0009 \text{ mol} \checkmark$$

$$m((\text{BaBr}_2)) = nM$$

$$m((\text{BaBr}_2)) = 0,0009 \times 297 \checkmark = 0,27 \text{ g} \checkmark$$

(5)

3.3.2 POSITIVE MARKING FROM Q 3.3.1

$$\% \text{ yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100$$

$$90 \checkmark = \frac{\text{actual yield}}{0,27} \times 100 \checkmark$$

$$\text{Actual yield} = 0,24 \text{ g} \checkmark$$

(3)

[18]

QUESTION 4

4.1 The amount of solute a given solution contains at a given temperature. ✓✓
[2 or 0 mark] (2)

4.2.1 $n = CV$ ✓

$$n = (0,05)(0,036) \text{ ✓}$$

$$n = 0,0018 \text{ mol. ✓} \quad (3)$$

4.2.2 **POSITIVE MARKING FROM Q 4.2.1**

$$n(\text{H}_2\text{SO}_4) : n(\text{Na}_2\text{CO}_3) = 1:1 \text{ ✓}$$

$$n(\text{Na}_2\text{CO}_3) = 0,0018 \text{ mol}$$

$$m = nM \text{ ✓}$$

$$m = 0,0018 \times 106 \text{ ✓} = 0,19 \text{ g ✓}$$

$$\% \text{ of } \text{Na}_2\text{CO}_3 = \frac{\text{mass of Na}_2\text{CO}_3}{\text{impure mass}} \times 100$$

$$\% \text{ of } \text{Na}_2\text{CO}_3 = \frac{0,19}{1,2} \times 100 \text{ ✓}$$

$$\% \text{ of } \text{Na}_2\text{CO}_3 = 15,83 \% \text{ ✓} \quad (6)$$

4.2.3 **POSITIVE MARKING FROM Q 4.2.1**

$$n(\text{H}_2\text{SO}_4) : n(\text{CO}_2) = 1:1$$

$$n(\text{CO}_2) = 0,0018 \text{ mol}$$

$$n(\text{CO}_2) = \frac{V}{V_M} \text{ ✓}$$

$$0,0018 = \frac{V}{22,4} \text{ ✓}$$

$$V_{(\text{CO}_2)} = 0,0403 \text{ mol.dm}^{-3} \text{ ✓}$$

(3)
[14]
TOTAL:50