Education

KwaZulu-Natal Department of Education
REPUBLIC OF SOUTH AFRICA

PHYSICAL SCIENCES

MARKING GUIDELINES

COMMON TEST

SEPTEMBER 2023

NATIONAL

SENIOR CERTIFICATE

GRADE 11

Stanmorephysics

VERIFIED

NB: This memorandum consists of 8 pages.

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QUESTION ONE

1.1 B ✓✓
1.2 C ✓✓
1.3 C ✓✓
1.4 D ✓✓
1.5 D ✓✓
1.6 A ✓✓ **[12]**

QUESTION TWO

2.1 Simplest whole number ratio of atoms in a compound ✓✓ (2)

2.2 Percentage O = 100 - (58,065 + 7,527)
= 34,408%✓ (1)

2.3

	C	H	O	
Mass in 100g	58,065g	7,527g	34,408g	✓
n = m/M	$\frac{58,065g}{12}$	$\frac{7,527g}{1}$	$\frac{34,408g}{16}$	✓
	= 4,83875	= 7,527	= 2,1505	
Divide by smallest mol	$\frac{4,83875}{2,1505}$	$\frac{7,527}{2,1505}$	$\frac{2,1505}{2,1505}$	✓
Ratio	2,25	3,5	1	
	9	14	4	
				(5)
Empirical formula	$C_9H_{14}O_4$ ✓✓			

2.4 M ($C_9H_{14}O_4$) = 9(12) + 14(1) + 4(16) ✓
= 186 $g.mol^{-1}$
∴ molecular formula is $C_9H_{14}O_4$✓ (2)

[10]

QUESTION 3

3.1

3.1.1 The reactant that gets finished first / is used up completely in a chemical reaction ✓✓ (2)

NOTE: For questions 3.1.2 and 3.1.3, award marks if ONE table is provided for both questions.

3.1.2 **MARKING CRITERIA**:

- Formula n = $\frac{m}{M}$
- Substitution for mass(m) and molar mass (M) for Fe_2O_3
- Substitution for mass(m) and molar mass (M) for CO
- Ratio applied correctly 3:1 or 14,375: 4,792
- Final answer: Fe_2O_3

n Fe_2O_3 = $\frac{m}{M}$ ✓

= $\frac{2300}{2(56) + 3(16)}$ ✓

= 14,375 mol

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

= $\frac{1700}{12 + 16}$ ✓

= 60,71 mol

n Fe_2O_3 : n CO

3 : 1 ✓

Limiting reagent is Fe_2O_3 ✓ (5)

3.1.3 **POSITIVE MARKING FROM QUESTION 3.1.2**

$Fe_2O_3 : Fe_3O_4$

3 : 2

14,375 : x

x = $\frac{4,375 \times 2}{3}$ ✓

= 9,58mol

n (Fe_3O_4) = $\frac{m}{M}$

9,58 = $\frac{m}{232}$ ✓

m = 2222,56g / 2,22 kg ✓

M Fe_3O_4 = 3(56) + 4(16)

= 232 g.mol^{-1} (3)

3.1.4 **POSITIVE MARKING FROM QUESTION 3.1.3**

Actual mass of Fe_3O_4 produced = $\frac{76}{100}$ ✓ × 2222,56✓
= 1689,15 g✓ (3)

3.2 2 vols SO_2 reacts with 1 vol O_2
5 vols SO_2 reacts with 2,5 vols O_2 to produce 5 vols SO_3✓

Total volume = (3-2,5) ✓ +5 ✓= 5,5 vols✓ (4)
[17]

QUESTION 4

4.1 **MARKING CRITERIA**:

- Substitution of 262 g·mol^{-1} into formula ($n = \frac{m}{M}$) to convert 16 g of $Mg_3(PO_4)_2$ to moles. ✓
- Apply ratio of 3:1 for n($Mg_3(PO_4)_2$) : n($Mg(OH)_2$). ✓
- Substitution of 58 g·mol^{-1} to calculate mass of pure $Mg(OH)_2$. ✓
- Substitution into correct formula to calculate % purity. ✓
- Final answer. ✓

$Mg_3(PO_4)_2$ produced: $n = \frac{m}{M}$
$= \frac{16}{262}$✓ = 0,061 mol

Mol of pure $Mg(OH)_2$ used = 3(0,061) ✓ = 0,183 mol

Mass of $Mg(OH)_2$ used: m = nM = 0,183 x 58✓
= 10,614 g

% purity = $\frac{10,612}{15} \times 100$ ✓
= 70,76 %✓ (5)

4.2.1 Increases. ✓ (1)

4.2.2 Remains the same. ✓ (1)

4.3 The ratio of the mass of pure $Mg(OH)_2$ in a given sample to the total mass of the sample remains constant. ✓✓ (2)

[9]

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QUESTION 5

5.1 The volume of an enclosed mass of (dry) gas is inversely proportional to the pressure when the temperature remains constant.✓✓ (2)

5.2.1 pressure✓ (1)

5.2.2 volume✓ (1)

5.3 Mass (of gas) ✓
Temperature (of gas)✓ (2)

5.4 $p_1V_1 = p_2V_2$

(250)(180) = (**x**)(135) ✓

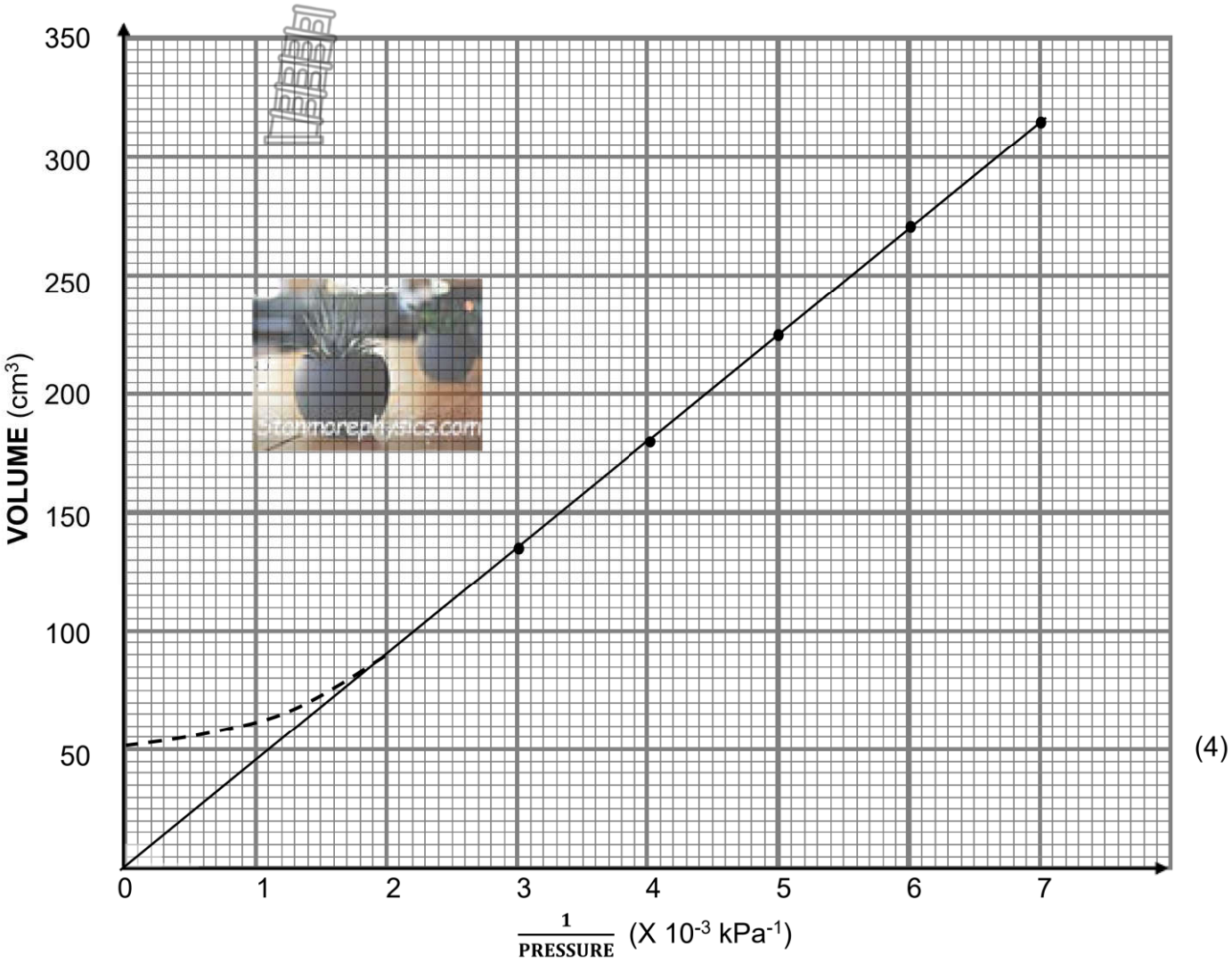
x = 333,33 (kPa) ✓ OR ANY VALUES FROM TABLE (2)

5.5.1 **POSITIVE MARKING FROM QUESTION 5.4**

Pressure(kPa)	**Volume(cm^3)**	$\frac{1}{P}$ **(x 10^{-3} kPa^{-1})**
142,9	315	7
166,7	270	6
200	225	5
250	180	**4**✓
333,3	135	**3**✓

(2)

Graph of Volume vs 1/Pressure



(4)

Marking Rubric

	Criteria	Mark
1	Volume on y-axis and Inverse of pressure on x-axis	1
2	All points correctly plotted -1 if more than 2 points plotted incorrectly	2
3	Line of best fit drawn	1
4	Deviation for Question 5.9	2

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5.6 Volume is directly proportional to 1/pressure OR v α 1/p. ✓✓ (2)

5.7 Particles: are identical in all respects.✓ / are in a state of random motion.✓ collisions are completely elastic / no force of attraction or repulsion except when they collide / particles themselves do not have volume.
(any two) (2)

5.8 High pressure ✓ Low temperature✓ (2)

5.9 On graph/ see Rubric✓✓ (2)
[23]

QUESTION 6

6.1 Endothermic.✓
$\Delta H > 0$ ✓ / $E_p > E_r$ (2)

6.2 The unstable transition state from reactants to products.✓✓ (2)

6.3.1 -15 kJ✓ (*Accept 15 kJ*) (1)

6.3.2 0 (kJ)✓ (1)

6.3.3 40 kJ✓ (*Accept 10 kJ*) (1)

6.4 $\Delta H = E_{products} - E_{reactants}$
✓ ✓
$= 0 - (-15)$
$= +15$ kJ✓ (3)

Accept: 0 – 15
= -15 kJ

6.5.1 Decreases.✓ (1)

6.5.2 Remains the same.✓ (1)

6.5.3 Remains the same.✓ (1)

6.5.4 Remains the same.✓ (1)
[14]

QUESTION 7

7.1 A solution whose concentration is known precisely. ✓✓ (2)

7.2

OPTION 1

$c = \frac{m}{MV}$ ✓

$0,2$ ✓ $= \frac{m}{(84)(0,25)}$ ✓

$m = 4,2g$ ✓

OPTION 2

$c = \frac{n}{V}$ ✓

$0,2 = \frac{n}{0,25}$ ✓

$n = 0,05$ mol

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

$0,05 = \frac{m}{84}$ ✓

$m = 4,2g$ ✓

(4)

7.3 Substance that produces hydronium ions (H_3O^+) when dissolved in water. ✓✓ (2)

7.4 $n(NaHCO_3) = C \times V$

$= 0,2 \times 0,05$ ✓

$= 0,01$ mol

$NaHCO_3 : CO_2$

1 : 1

$n\ CO_2 = 0,01$ mol ✓

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

$0,01 = \frac{V}{23}$ ✓

$V = 0,23\ dm^{-3}$ ✓

(4)

7.5.1 CH_3COOH ✓ (2)

7.5.2 CO_3^{2-} ✓ (2)

[16]

TOTAL: 100

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