



MOGALAKWENA DISTRICT

PHYSICAL SCIENCES

NATIONAL SENIOR CERTIFICATE

TERM 3 CONTROLLED TEST
08 SEPTEMBER 2023
GRADE 11
MEMORANDUM

MARKS: 100

This question paper consists of 8 pages including this one

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

1.1 D ✓✓

1.2 A ✓✓

1.3 B ✓✓

1.4 A ✓✓

1.5 D ✓✓

[12]**QUESTION 2**

2.1 Exothermic ✓
Reactants at higher energy than products./Products at lower energy than reactants./Energy is released./ $\Delta H < 0$. ✓

(2)

2.2

2.2.1 A ✓ (1)

2.2.2 A - B ✓ (1)

2.2.3 B ✓ (1)

2.2.4 B - C ✓ (1)

2.3 1 mol Ba(OH)_2 releases: 116 kJ ✓
0,18 mol Ba(OH)_2 release: $0,18 \times 116$ ✓ = 20,88 kJ ✓
(Accept answers in range: 20,3 - 20,88 kJ) (3)

[9]

QUESTION 33.1 CO₂ ✓

(1)

3.2 The amount of substance ✓ having the same number of particles as there are atoms in 12 g carbon-12. ✓

(2)

3.3

$$n(\text{NaHCO}_3) = \frac{m}{M} \quad \checkmark$$

$$\begin{aligned} &= \frac{3,36}{84} \quad \checkmark \\ &= 0,04 \text{ mol} \quad \checkmark \end{aligned}$$

(3)

3.4 **POSITIVE MARKING FROM QUESTION 3.3.**

$$\begin{aligned} n(\text{H}_3\text{C}_6\text{H}_5\text{O}_7) &= \frac{m}{M} \\ &= \frac{1,8}{192} \quad \checkmark \\ &= 0,01 \text{ mol} \quad (9,38 \times 10^{-3} \text{ mol}) \end{aligned}$$

$$\begin{aligned} n(\text{NaHCO}_3 \text{ needed}) &= 3n(\text{H}_3\text{C}_6\text{H}_5\text{O}_7) \\ &= 3(0,01) \text{ mol} \quad \checkmark \\ &= 0,03 \text{ mol} \quad \checkmark \end{aligned}$$

$$n(\text{NaHCO}_3) < n(\text{NaHCO}_3 \text{ in antacid})$$

H₃C₆H₅O₇/citric acid is the limiting reactant. ✓

(4)

3.5 **POSITIVE MARKING FROM QUESTION 3.3 & 3.4.**

$$\begin{aligned} n(\text{NaHCO}_3 \text{ in excess}) &= 0,04 - 0,03 \quad \checkmark \\ &= 0,01 \text{ mol} \end{aligned}$$

$$\begin{aligned} m(\text{NaHCO}_3 \text{ in excess}) &= nM \\ &= (0,01)(84) \quad \checkmark \\ &= 0,84 \text{ g} \quad \checkmark \end{aligned}$$

(3)

3.6 **POSITIVE MARKING FROM QUESTION 3.4.**

$$n(\text{CO}_2) = \frac{m}{M}$$

$$\therefore 0,03 \checkmark = \frac{m}{44} \checkmark$$

$$\therefore m(\text{CO}_2) = 1,32 \text{ g} \checkmark (3)$$

Marking criteria:

- Using $M(\text{CO}_2) = 44 \text{ g} \cdot \text{mol}^{-1}$
- $3(\text{CO}_2) = n(\text{NaHCO}_3)$
- Final answer: 1,32 g

[16]**QUESTION 4**

4.1 Amount of solute per litre of solution. ✓✓

(2)

4.2

$$C = \frac{m}{MV} \checkmark$$

$$c = \frac{156}{8(0,5)} \checkmark$$

$$c = 0,10 \text{ mol} \cdot \text{dm}^{-3} \checkmark$$

(3)

4.3.1 Empirical formula is the simplest whole number ratio between the elements in a compound. ✓✓

(2)

4.3.2

Element	$\frac{g}{100g}$	$n = \frac{m}{M}$	Simplest ratio
K	26,58	$26,58/39 = 0,68 \checkmark$	$1 \times 2 = 2 \checkmark$
Cr	35,35	$35,35/52 = 0,68 \checkmark$	$1 \times 2 = 2 \checkmark$
O	38,07	$38,07/16 = 2,38 \checkmark$	$3,5 \times 2 = 7 \checkmark$

Empirical formula = $\text{K}_2\text{Cr}_2\text{O}_7 \checkmark$

(7)

[14]

QUESTION 5

5.1 Boyle's law✓ (1)

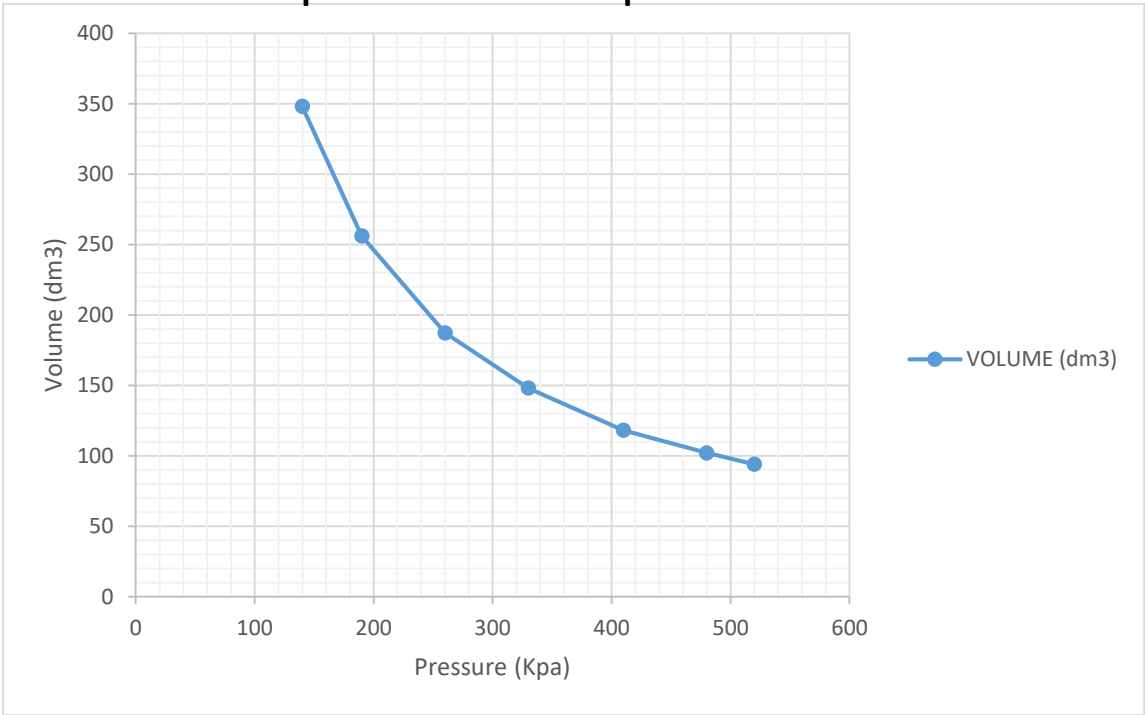
5.2	Criteria for hypothesis	
	The dependent and independent variables are stated correctly.	✓
	State the relationship between the dependent and independent variables.	✓
	Dependent variable : volume Independent variable : pressure	

Example:
If the pressure of and enclosed gas increases the volume will decreases at constant temperature.
The pressure of an enclosed gas is inversely proportional to the volume it occupies if the temperature is kept constant.

(2)

5.3

Graph of volume versus pressure



Criteria for marking the graph	
Use of correct scale on both axis (If learners used table values as scale values maximum $\frac{1}{3}$ for line drawn) <i>Clearly indicated pressure on the x-axis and volume on the y-axis with the correct S.I unit</i>	✓✓
At least five (5) points plotted correctly	✓
Curve is drawn	✓

(4)

5.4 Any set of values can be used from the table :

$$\begin{aligned}
 p_1V_1 &= p_2V_2 \checkmark \\
 140(348) &= 600V_2 \\
 V_2 &= 81,20 \text{ dm}^3 \checkmark \\
 (\text{Accept : } 80,64 - 81,60 \text{ dm}^3) & \quad (3)
 \end{aligned}$$

5.5 At high pressure a gas starts to deviate from ideal gas behaviour ✓
because the volume of the molecules of a gas and the intermolecular forces start to influence the measured value, causing it to be greater than the theoretical value calculated/Forces of repulsion between the gas particles prevents them from moving closer ✓ (2)

5.6  Low ✓

(1)

5.7 Temperature is an indication of the average kinetic energy of the molecules of a gas. If the temperature of a gas decreases, the molecules move slower and closer together ✓ up to a point where the gas will start to condense ✓ and not behave like an ideal gas.
OR

The intermolecular forces of attraction becomes significant ✓ then the gas condenses. ✓ (2)

$$\begin{aligned}
 5.8 \quad pV &= nRT \checkmark \\
 (140\,000)(348 \times 10^{-3}) \checkmark &= n(8,31)(293) \checkmark \\
 n &= 20 \text{ moles } \checkmark \quad (4)
 \end{aligned}$$

[18]

QUESTION 6

6.1 An acid is a proton donor. ✓✓ (2)

6.2 $\text{H}_2\text{SO}_4 + \text{MgCO}_3 \rightarrow \text{MgSO}_4 + [\text{H}_2\text{O} + \text{CO}_2]$ ✓ (2)

6.3

- Bronsted-Lowry acid: HBr, ✓ Conjugate base is Br-/NaBr ✓
- Bronsted-Lowry base: CN- (NaCN), ✓ Conjugate base is HCN ✓ (4)

6.4 Ampholyte Accept: Amphiprotic ✓ (1)

6.5

6.5.1 Neutralisation ✓ (1)

6.5.2 $\text{H}_2\text{SO}_4(\text{aq}) + \text{KOH}(\text{aq}) \rightarrow \text{K}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$ ✓ Bal. ✓

Notes:

- Reactants ✓ Products ✓ Balancing: ✓
- Ignore double arrows.
- Marking rule

(3)

6.5.3 Blue ✓ to yellow ✓ (2)

6.5.4 Potassium sulphate ✓ (1)

[14]

QUESTION 7

7.1

7.1.1 Oxidation is an increase in oxidation number. ✓✓

(2)

7.1.2 $2\text{Cr} + 7\text{O} = -2$ ✓ $2\text{Cr} + (-14) = 2$ $\text{Cr} = +6$ ✓

(2)

7.1.3 $2\text{H} + 2\text{O} = 0$ ✓ $2 + 2\text{O} = 0$ $\text{O} = -1$ ✓

(2)

7.2

7.2.1 A substance whose oxidation number increases. ✓✓

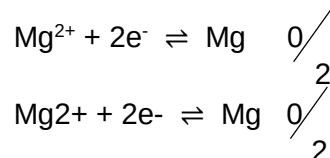
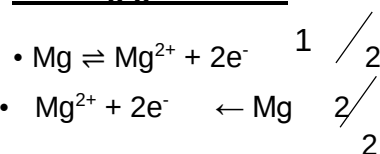
(2)

7.2.2 Mg/ Magnesium ✓

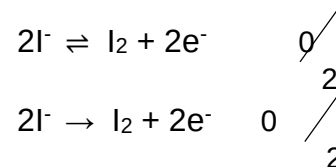
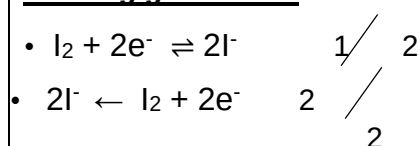
(1)

7.2.3 I_2 ✓

(1)

7.2.4 $\text{Mg (s)} \rightarrow \text{Mg}^{2+} + 2\text{e}^-$ ✓✓**Marking guidelines:**

(2)

7.2.5 $\text{I}_2 + 2\text{e}^- \rightarrow 2\text{I}^-$ ✓✓**Marking guidelines:**

(2)

7.2.6 $\text{Mg(s)} + \text{I}_2\text{(s)} \rightarrow \text{Mg}^{2+}\text{(aq)} + 2\text{I}^-$ ✓✓**Notes:** Ignore double arrows.

(2)

[16]**[100]**