



**higher education
& training**

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE

(Second paper)

NQF LEVEL 3

21 November 2022

This marking guideline consists of 8 pages.

SECTION A**QUESTION 1**

- 1.1 Greenhouse effect
- 1.2 Exothermic
- 1.3 Combination
- 1.4 Strain
- 1.5 Brittleness

(5 × 1) **[5]**

QUESTION 2

- 2.1 G
- 2.2 I
- 2.3 B
- 2.4 C
- 2.5 H

(5 × 1) **[5]**

QUESTION 3

- 3.1 False
- 3.2 False
- 3.3 True
- 3.4 False
- 3.5 True

(5 × 2) **[10]**

QUESTION 4

- 4.1 B
- 4.2 A
- 4.3 C
- 4.4 C
- 4.5 D

(5 × 3) **[15]**

TOTAL SECTION A: 35

SECTION B**QUESTION 5**

- 5.1 5.1.1 The deformation of a material is directly proportional to the force applied on it. The strain in a solid is proportional to the applied stress within the elastic limit of that solid. (2)
- 5.1.2 (a) C
(b) B
(c) D
(d) A

(4 × 1) (4)
- 5.2 5.2.1 • They have the same number (and arrangement) of electrons.
• They have ten electrons each.
• They are both charged atoms (ions). (Any 1 × 1) (1)
- 5.2.2 (a) Metallic
(b) (Non-polar) covalent
(c) Ionic

(3 × 1) (3)
- 5.2.3 $\left[\text{Mg} \right]^{+2} \checkmark \checkmark$ $\left[\begin{array}{c} \times \times \\ \cdot \times \\ \times \cdot \times \\ \times \end{array} \text{O} \begin{array}{c} \times \\ \times \\ \times \end{array} \right]^{-2} \checkmark \checkmark$

(Electrons = ✓ Charge = ✓) (4)
- 5.2.4 $\text{MgO} = 0$
 $\text{Mg} + (-2) = 0$
 $\text{Mg} = +2$ (1)
- 5.3 5.3.1 • Molar mass
• Relative molar mass
• Molecular mass
• Relative molecular mass (Any 1 × 1)
- (Type of/strength of) intermolecular forces/functional group (Any 1 × 1) (2)
- 5.3.2 Ethanol (1)

- 5.3.3
- Ethanol has both Van der Waals forces (London forces) and hydrogen bonding. Dimethyl ether has only Van der Waals forces (London forces).
 - The intermolecular forces are stronger in ethanol.
 - More energy is required to break the intermolecular forces in ethanol during boiling.

(3)
[21]

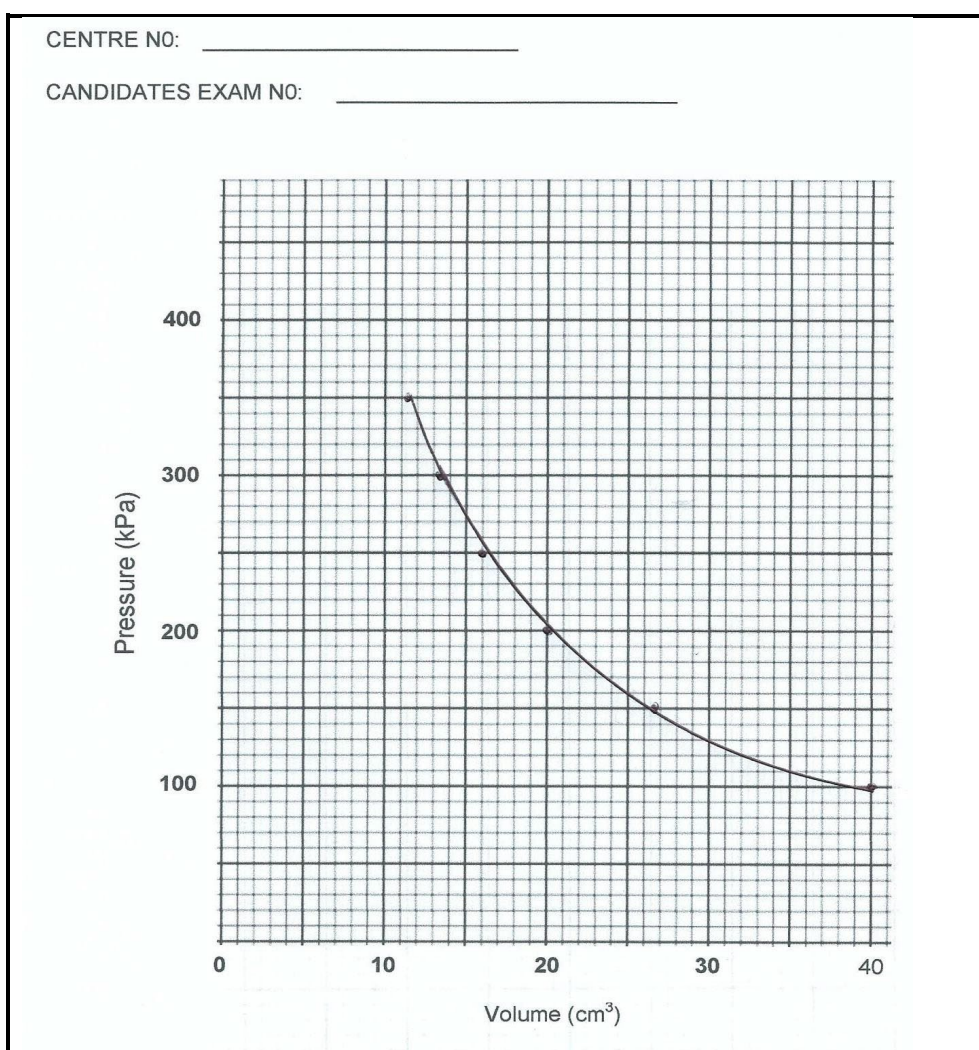
QUESTION 6

6.1 6.1.1 Marking guidelines for the graph:

- Pressure (kPa) along Y-axis✓
- Volume (cm³) along X-axis✓
- Correct shape of graph (one continuous smooth curve)✓
- ALL points plotted accurately✓✓

OR

- At least three points plotted accurately✓



(5)

- 6.1.4 Units of (pressure x volume) = Pa (m³)✓ = (N·m⁻²✓)(m³) = N·m✓ = J (3)

$$6.2 \quad 6.2.1 \quad n = \frac{m}{M} = \frac{64}{32} = 2 \text{ mol} \checkmark$$

OPTION 2

$$\frac{pV}{nRT} = 1$$

$$(658 \times 10^3) \text{ V} \checkmark = (2)(8,31)(726 \text{ or } 726,15) \checkmark$$

$$V = 18.34 \times 10^{-3} \text{ m}^3$$

(5)

- 6.3 Absolute pressure = gauge pressure + atmospheric pressure✓
= 250 + 101,3✓
= 351,3kPa✓ (3)

7.1.2 The jar will expand✓ and the lid will fit tighter✓ and it will be more difficult to open the jar. (2 × 2) (4)

- 7.2.2 $\Delta V = \beta V_o \Delta T \checkmark$
 $= (7,5 \times 10^{-5}) \times (1000) \times (48 - 21)$ OR $(7,5 \times 10^{-5}) \times (1000) \times (27) \checkmark$
 $= 202,5 \times 10^{-2} \text{ dm}^3$
 $= 2,025 \text{ dm}^3$ OR $2\,025 \text{ cm}^3$ of water will overflow $\checkmark$ (3)

- 7.2.3
- If the temperature increases, the viscosity decreases.
 - If the temperature decreases, the viscosity increases.
 - Generally the higher the temperature the lower the viscosity of the liquid.
- (Any 2 × 1) (2)

7.3	7.3.1	- The temperature increased. - The blue solution became colourless. - A brown solid was formed.	(Any 2 × 1)	(2)
	7.3.2	(a) $\text{Zn} + \text{CuSO}_4 \longrightarrow \text{ZnSO}_4 + \text{Cu}$ OR $\text{Zn} + \text{Cu}^{2+} \rightarrow \text{Zn}^{2+} + \text{Cu}$	(Reactants = ✓ Products = ✓)	(2)
		(b) SO_4^{2-}		(2)
		(c) (Metal) displacement (reaction) - Redox (reaction)	(Any 1 × 1)	(1)
	7.3.3	$\text{Cu}, \checkmark \text{Zn}, \checkmark \text{Mg} \checkmark$		(3)
				[21]

QUESTION 8

8.1	8.1.1	$2\text{AB} \longrightarrow \text{A}_2 + \text{B}_2$	(Reactants = ✓ Products = ✓)	(2)
	8.1.2	Decomposition		(1)
	8.1.3	Exothermic		(1)
	8.1.4	ΔH is negative (less than 0) OR $\Delta H < 0$ - Net release of energy/More energy is given off than taken in. - The products have less potential energy than the reactants.	(Any 2 × 1)	(2)
	8.1.5	$100 \checkmark \text{ kJ} \cdot \text{mol}^{-1} \checkmark$		(2)
	8.1.6	$\Delta H = E_p(\text{Products}) - E_p(\text{Reactants}) \checkmark$ $= (250) - (170)$ $= + 80 \text{ kJ} \cdot \text{mol}^{-1} \checkmark$		(2)
8.2	8.2.1	$n(\text{Cu}) = \frac{m}{M} \checkmark = \frac{101,6}{63,5} \checkmark = 1,6 \text{ mol} \checkmark$		(3)
	8.2.2	(Positive marking from QUESTION 8.2.1 to QUESTION 8.2.2) $n(\text{CuSO}_4) = 1,6 \text{ mol}$		(1)

8.2.3 (Positive marking from QUESTION 8.2.2 to QUESTION 8.2.3)

OPTION 1

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

$$1,6 \checkmark = \frac{m}{159,5 \checkmark}$$

$$m = 255,2 \text{ g} \checkmark$$

OPTION 2

1 mol Cu produces 1 mol CuSO₄ ✓

$$63,5 \text{ g} \checkmark \longrightarrow 159,5 \text{ g} \checkmark$$

$$101,6 \text{ g} \longrightarrow x$$

$$x = (101,6 \times 159,5) / 63,5$$

$$= 255,2 \text{ g} \checkmark$$

(4)

8.2.4 (Positive marking from QUESTION 8.2.1 to QUESTION 8.2.4)

OPTION 1

$$n = \frac{V}{V_M} \checkmark$$

$$1,6 \checkmark = \frac{V}{22,4} \checkmark$$

$$V = 35,84 \text{ dm}^3 \checkmark$$

OPTION 2

From the balanced chemical equation:

63,5 g Cu produce 64g SO₂ ✓

i.e. 63,5 g $\longrightarrow$ [32 + 2(16)]g

63,5 g $\longrightarrow$ 64 g

101,6 g $\longrightarrow$ x

OR

159,5g CuSO₄ is produced with 64 g SO₂

255,2g CuSO₄ will be produced with x SO₂

$$x = (255,2 \times 64) / 159,5$$

$$= 102,4 \text{ g}$$

$$X = (101,6 \times 64) / 63,5$$

$$= 102,4 \text{ g}$$

$$n(\text{SO}_2) = 102,4/64$$

$$= 1,6 \text{ mol} \checkmark$$

At STP 1 mol SO₂ occupies 22,4 dm³ ✓

1,6 mol SO₂ will occupy 35,84 dm³

The volume of SO₂ produced at STP is 35,84 dm³ ✓

(4)

8.3 8.3.1 Combination

(1)

8.3.2 H₂✓ N₂✓

(2)

$$8.3.3 \quad n = \frac{m}{M} \checkmark = \frac{23,8}{17} \checkmark = 1,4 \text{ mol} \checkmark$$

$$\text{Heat produced} = 1,4 (46) \checkmark = 64,4 \text{ kJ} \checkmark$$

(5)

[30]

QUESTION 9

- 9.1 9.1.1 Decomposition (1)
- 9.1.2 $2\text{Pb}(\text{NO}_3)_2 \longrightarrow 2\text{PbO} + \text{O}_2 + 4\text{NO}_2$
- (Balancing of reactants = ✓ Balancing of products = ✓) (2)
- 9.1.3 Lead oxide, ✓ nitrogen (iv) oxide or nitrogen dioxide ✓ and oxygen ✓ (3)
- 9.2 9.2.1 CaO
- 9.2.2 NaOH ✓ + H₂ ✓
- 9.2.3 NaF ✓ + Br₂ ✓
- 9.2.4 H₃PO₄
- (4 × 2) (8)
- 9.3 Single displacement reaction / Redox reaction (1)
- [15]**

QUESTION 10

- 10.1 10.1.1 Hazardous gases are gases that are regarded as poisonous or flammable ✓ or can cause asphyxiation. ✓ (2)
- 10.1.2 Waste products are by-products that are considered to have no use to a company ✓ and are therefore discarded. ✓ (2)
- 10.1.3 Carbon monoxide (1)
- 10.2 • Sulphur dioxide (SO₂)
- Carbon dioxide (CO₂)
- Nitrogen oxide (NO) (3)
- [8]**

TOTAL SECTION B: 115
GRAND TOTAL: 150