higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE
(Second paper)
NQF LEVEL 3

30 November 2023

This marking guideline consists of 9 pages.

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SECTION A

QUESTION 1

1.1 Noble gases/Inert gases
1.2 Ductile/Ductility
1.3 Metallic (bond)
1.4 Oxygen
1.5 Exothermic

(5 × 1) **[5]**

QUESTION 2

2.1 E
2.2 H
2.3 J
2.4 I
2.5 A

(5 × 1) **[5]**

QUESTION 3

3.1 False
3.2 True
3.3 False
3.4 True
3.5 True

(5 × 2) **[10]**

QUESTION 4

4.1 C
4.2 A
4.3 B
4.4 B
4.5 D

(5 × 3) **[15]**

TOTAL SECTION A: 35

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SECTION B

QUESTION 5

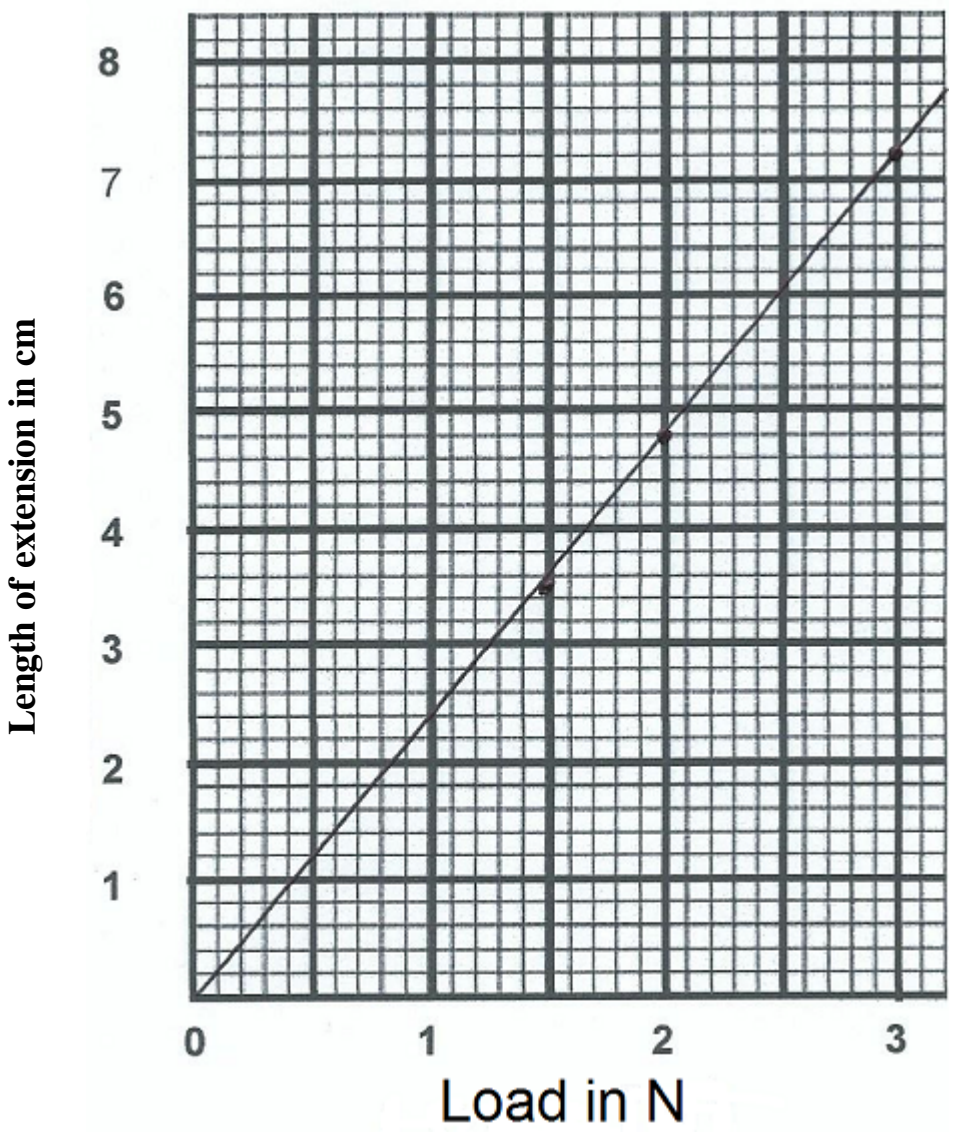
5.1 5.1.1 The deformation of a material is directly proportional to the force applied on it, provided the elastic limit is not exceeded. (2)

5.1.2 Y = 4,8 (1)

5.1.3 Graph of length of extension versus load.

Marking guidelines:

1. Label on x-axis (Load/Force in N) and Label on y-axis (Length of extension/distortion/elongation in cm).✓
3. Accurate plotting of points.✓✓
4. Straight line passing through the origin.✓ (4)

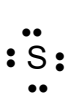


5.1.4 Yes. (1)

5.1.5 The graph is a straight line,✓ passing through the origin.✓ (2)

5.2 5.2.1 $1s^2$✓, $2s^2\ 2p^6$✓, $3s^2\ 3p^6$✓ (3)

5.2.2



Marking guidelines:

Shows 4 pairs of electrons.✓ Shows charge of -2.✓ (2)

5.2.3 Ca^{+2} or Ca^{2+} ,
K^{+} or K^{+1} or K^{1+} ,
Cl^{-} or Cl^{-1} or Cl^{1-},
P^{-3} or P^{3-} (Any 2 × 1) (2)

5.3 5.3.1 CO_2
5.3.2 PH_3
(2 × 1) (2)
[19]

QUESTION 6

6.1 6.1.1 **OPTION 1**

PV = nRT ✓
(125)(3,6) ✓ = n(8,31✓)(328✓)
n = 0,17 mol ✓

Marking guidelines:
Equation ✓
LHS substitution✓
Insertion of 8,31 for R ✓
Temperature conversion ✓
Ans with unit ✓

OPTION 2

PV = nRT✓
(125 x 10^3)(3,6 x 10^{-3}) ✓ = n(8,31✓)(328✓)
n = 0,17 mol ✓ (5)

6.1.2 Positive marking from Question 6.1.1 to Question 6.1.2.
$n = \frac{m}{M}$✓
$0{,}17 = \frac{m}{28}$✓
$m(N_2) = 4{,}76\ g$✓ (3)

6.2 6.2.1 The pressure of an enclosed mass of gas is directly proportional to the absolute temperature of the gas, provided the volume is kept constant. (2)

6.2.2 $\frac{p_1}{T_1} = \frac{p_2}{T_2}$ ✓

$\frac{100}{298} = \frac{50}{x}$ ✓

$x = 149\ K$ ✓ = *–124 °C* ✓ (4)

6.2.3 $pV = nRT$

$pV = \frac{mRT}{M}$

1 mark for any one equation ✓

$Gradient = \frac{p}{T} = \frac{mR}{VM}$ ✓

Since R, V and M are constant

The gradient is directly proportional to the mass of the sample. ✓

Sample B has a smaller mass. ✓ (4)

[18]

QUESTION 7

7.1 7.1.1 Vapour pressure is the pressure exerted by a vapour in equilibrium with the liquid.

7.1.2 Boiling point is the temperature at which the vapour pressure of a liquid is equal to the pressure in the atmosphere.

(2 × 2) (4)

7.2
- The temperature/kinetic energy increases.
- The particles begin to vibrate faster/more vigorously/more violently.
- The particles of the solid are pushed further apart./The particles need more space to move about. (3)

7.3 7.3.1 Hydrogen bonding.

7.3.2 Van der Waals forces/London forces/Dispersion forces.

(2 × 1) (2)

7.4 7.4.1 Liquid (2)

7.4.2 Because now the liquid is changing phase to solid.
A phase change occurs/takes place.
The particles come closer together.
Latent heat of fusion is released. ✓

Any ONE
Max 1 mark ✓

The potential energy of the particles decreases. ✓
No change in the kinetic energy of the particles. ✓
Latent heat of fusion is released. ✓ (2)

7.4.3 50 °C (1)

[14]

QUESTION 8

8.1 8.1.1 A catalyst is a chemical substance that speeds up/increases the rate of a (chemical) reaction but remains unchanged/does not undergo any permanent chemical changes/is not consumed at the end of the reaction.

8.1.2 Enthalpy refers to the overall energy change in a reaction at constant pressure.

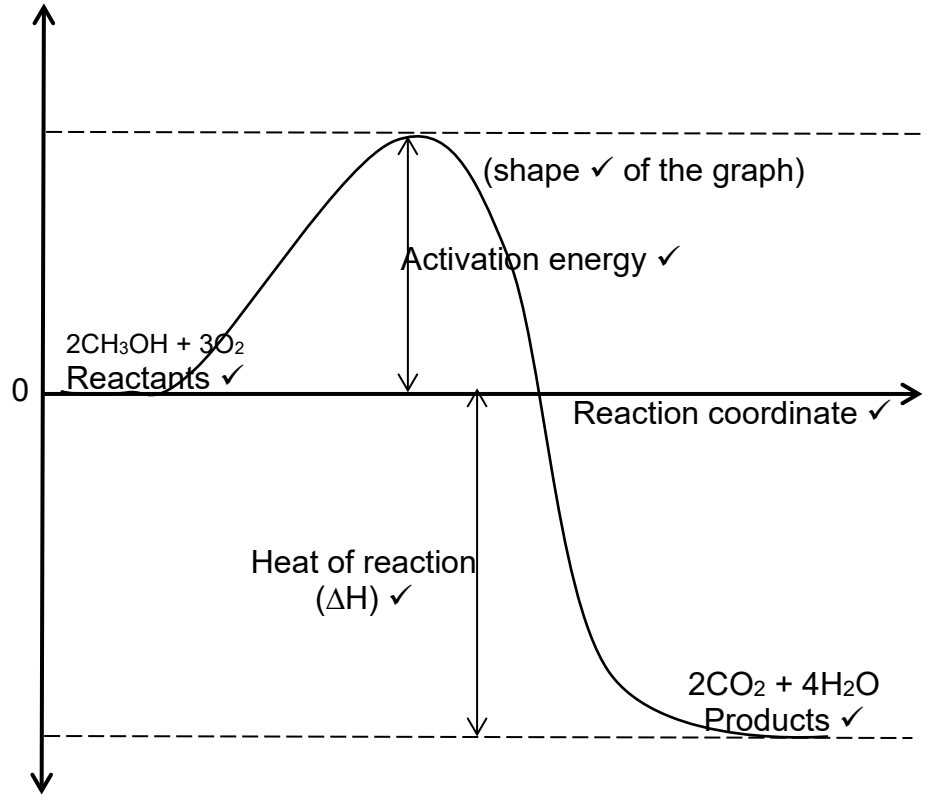
(2 × 2) (4)

8.2 8.2.1 Exothermic. (1)

8.2.2 Heat/energy is given off. (2)

8.2.3 $2CH_3OH + 3O_2 \longrightarrow 2CO_2 + 4H_2O$
Reactants✓ Products✓ Balancing✓ (3)

8.2.4



Marking guidelines:

For both labels (1 mark only)✓ Shape of graph✓
Activation energy✓ Heat of the reaction (ΔH)✓
Position of reactants✓ Position of products✓ (6)

8.3 8.3.1 $CaO + H_2O \longrightarrow Ca(OH)_2$ (1)

8.3.2 Combination/Synthesis (2)

8.3.3 $n = \frac{m}{M}$ ✓ $= \frac{30}{56}$ ✓ $= 0{,}536$ or $0{,}54$ mol✓ (3)

8.3.4 $CaO + H_2O \longrightarrow Ca(OH)_2$

Relative molar mass of reactants = (40 + 16) + (2 + 16)
= 56✓ + 18✓
= 74

Relative molar mass of products = (40 + 32 + 2) = 74✓

Since the relative molar mass of the reactants = the relative molar mass of the products, the mass is conserved. ✓ (4)
[26]

QUESTION 9

9.1 9.1.1
(a) Silver nitrate
(b) Sodium chloride
(c) Silver chloride
(d) Sodium nitrate
(4 × 1) (4)

9.1.2 **OPTION 1**

$\mathrm{n(NaCl)} = \frac{m}{M}$ ✓ $= \frac{10}{58{,}5}$ ✓ $= 0{,}1709\ mol$ ✓

$\mathrm{n}(AgNO_3)\ produced = 0{,}1709\ mol$

$\mathrm{n} = \frac{m}{M}$
$0{,}1709$ ✓ $= \frac{m}{170}$ ✓
$\mathrm{m}(AgNO_3) = 29{,}05\ g$ ✓

Marking guidelines
Max 1 mark for equation

OPTION 2

58,5✓ g NaCl produces 170✓ g $AgNO_3$
10 g NaCl will produce x ✓

$x = \frac{10(170)✓}{58{,}5✓} = 29{,}06\ g$ ✓ (6)

9.2 9.2.1 $Cl_2 + 2KBr \longrightarrow 2KCl + Br_2$

Marking guideline: 1 mark for each product✓✓ Balancing✓
Type of reaction: Displacement ✓

9.2.2 $N_2 + 3H_2 \longrightarrow 2NH_3$

Marking guideline: 2 marks for product ✓✓ Balancing✓
Type of reaction: Combination ✓

9.2.3 $2KClO_3(s) \longrightarrow 2KCl + 3O_2$

Marking guideline: 1 mark for each product✓✓ Balancing✓
Type of reaction: Decomposition✓

(3 × 4) (12)

9.3 **OPTION 1**

PV = nRT✓
(101,3)(44,8) ✓ = n(8,31)(273,15)✓
n = (101.3kPa × 44.8 dm^3) / (8.31 × 273.15)
= 2 mol✓

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

$2 = \frac{m}{28}$✓

$m = 56\ g$✓

OPTION 2

$n = \frac{V}{V_M}$✓ $= \frac{44,8}{22,4}$✓ $= 2\ mol$✓

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

$2 = \frac{m}{28}$✓

$m = 56\ g$✓ (6)

[28]

QUESTION 10

10.1 10.1.1 This is the layer of O_3 molecules in the upper levels of the earth's atmosphere that helps to protect the earth from harmful ultraviolet radiation.

10.1.2 Global warming refers to a rise in the average temperature of the earth's atmosphere as a result of a higher accumulation of greenhouse gases.

10.1.3 Pollutants are substances that cause harm to the environment when they mix with the earth's soil, water, or air.

(3 ×2) (6)

10.2 10.2.1 Nitrogen (N_2)
10.2.2 Oxygen (O_2)
10.2.3 Carbon dioxide (CO_2)
10.2.4 Methane (CH_4)

(4 × 1) (4)
[10]

TOTAL SECTION B: 115
GRAND TOTAL: 150

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