higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE

(Second paper)

NQF LEVEL 3

26 November 2024

This marking guideline consists of 7 pages.

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SECTION A

QUESTION 1

1.1 Molar gas volume
1.2 enthalpy
1.3 Combination
1.4 elasticity
1.5 Global warming

(5 × 1) **[5]**

QUESTION 2

2.1 G
2.2 E
2.3 A
2.4 D
2.5 B

(5 × 1) **[5]**

QUESTION 3

3.1 True
3.2 False
3.3 False
3.4 True
3.5 False

(5 × 2) **[10]**

QUESTION 4

4.1 A
4.2 D
4.3 C
4.4 C
4.5 D

(5 × 3) **[15]**

TOTAL SECTION A: 35

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SECTION B

QUESTION 5

5.1 5.1.1 Materials that can be drawn into wires without breaking
5.1.2 Materials that break up easily when subjected to stress
(2 × 2) (4)

5.2 Elastic material can recover their original shape and size after distortion√ whilst plastic material cannot recover when the force is removed. (2)

5.3 5.3.1 S^{2-} (1)
5.3.2 $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6$ (2)
5.3.3 Yes, it obeys, there are 8 electrons in the outer energy level (2)
5.3.4 Argon (1)

5.4 5.4.1 CH_4 is Van der Waal's forces.
NH_3 is hydrogen bonding.

5.4.2 NH_3 because it has a strong intermolecular force which is hydrogen bonding

5.4.3 The ~~C—H~~ bond is non-polar,✓ since the electronegativity difference is less than 0,9✓

5.4.4 The ~~N—H~~ bond is polar,✓ since the electronegativity difference is more than 0,9✓

5.4.5 (CH_4) tetrahedral✓
NH_3 distorted tetrahedral or pyramidal✓
(5 × 2) (10)

5.5 5.5.1 Particles in the liquid tend to vibrate longer distances than how solid particles vibrate and thus cause liquids to expand more rapidly than solids. (2)

5.5.2 $\Delta V = \beta V_o \Delta T$
$\Delta V = \beta\ V_o\ \Delta T$✓
$= 7,5 \times 10^{-5}/\ ^oC \times 100\ dm^3 \times (49 - 22)\ ^oC$✓✓
$= 0,2025\ dm^3$✓ (4)

5.5.3 Viscosity is inversely proportional to temperature. (2)
[30]

QUESTION 6

6.1
- The molecules of the gas are all identical.
- The distances between the molecules are very great.
- There are no forces between the molecules except during collision.
- The gas molecules only have volume because of the motion of the molecules and of the collisions between them.
- The collisions are perfectly elastic. (Any 3 × 1) (3)

6.2 The pressure of an enclosed mass of gas is inversely proportional to its volume at constant temperature. √ (2)

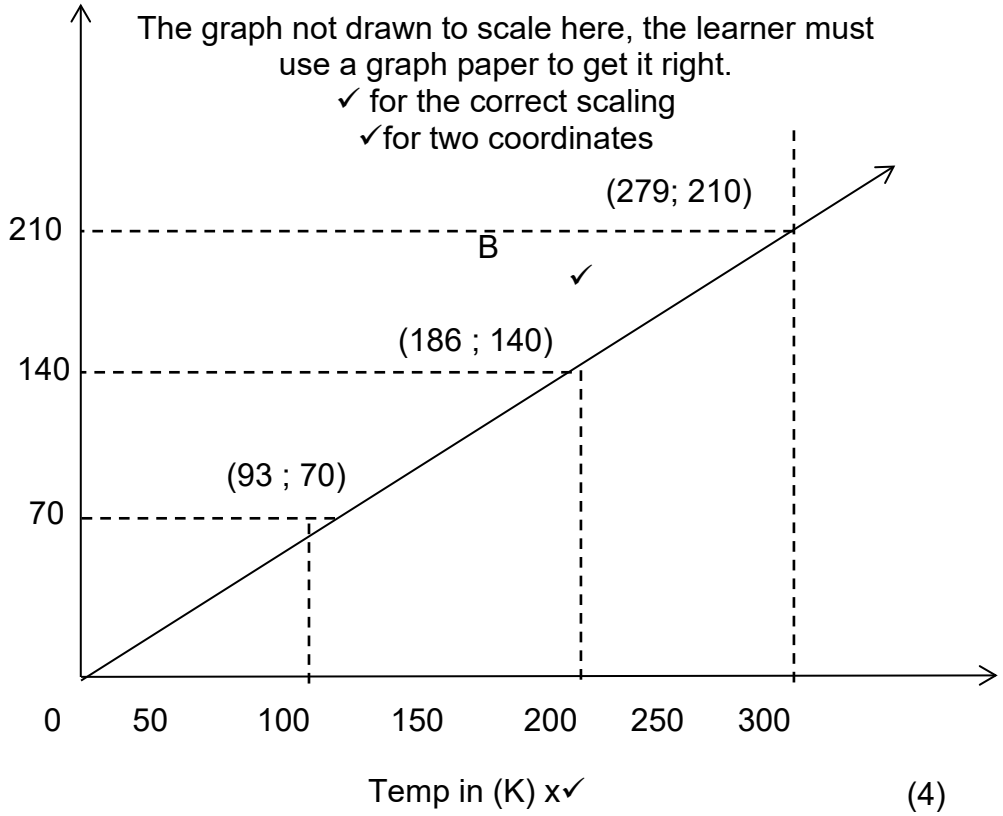
6.3 6.3.1

Volume in dm^3	Temperature in ^0C	Temperature in kelvins (K)
70	-179	93 ½ √
140	-87	186 ½ √
210	6	279 ½ √
280	99	372 ½ √

(2)

6.3.2 Charles' Law states that the volume of a gas varies directly with the absolute temperature (K), if the pressure and mass of the gas remain constant. (2)

6.3.3



(4)

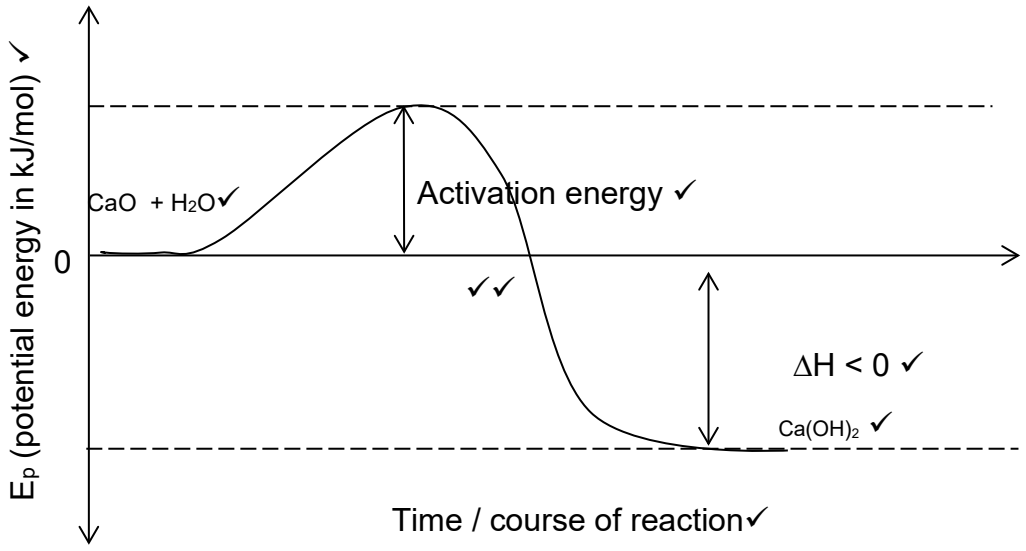
6.3.4 $V_1 / T_1 = V_2 / T_2$✓
$70 / 93 = V_2 / 393$✓✓
$V = 295.8\ dm^3$✓ (4)

6.4 It means that the amount of heat energy needed to raise the temperature of 1 kg of water by 1°C is 4200 kJ. (2)

6.5 Heat lost by aluminium = heat absorbed by water✓
$Mc\Delta t = mc\Delta t$✓
$C = m_{water}\, c\Delta t_{water} / m_{Al}\, \Delta t_{Al}$✓
$= 1,6/2 \times 4200 \times 20/70$✓
$= 960$ j/kg °C✓ (5)
[24]

QUESTION 7

7.1 Consider the following potential energy diagram below:



(8)

7.2 7.2.1 Calcium carbonate (2)

7.2.2 $Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$ (2)

7.2.3 Mass of reactants = 40 + 2(16 +1) + 12 + 2(16)✓ = 118g✓
Mass of products = 40 + 12 + 3(16) + 2(1) + 16✓ = 118g✓
Mass of products is equal to mass reactants (conserved)✓
22N T= 22N.✓ (5)

7.2.4 $M_{r(CO2)} = 12 + 2(16)$
44g/mol✓
$n_{(CO2)}$ = 10g/44 g/mol
= 0,227 mol $M_{r(CaCO3)} = 40 + 12 + 3(16)$
From the balanced equation: mol $CaCO_3$ = 0,227 mol 100 g/mol✓
Mass = $n \times M_r$
0,227 mol × 100 g/mol
= 22,72 g✓ (5)

7.3 7.3.1 Volume occupied by 1 mole of a gas at STP.√√ = 22 NT = 22 N.✓ (2)

7.3.2 268,8 dm^3 of SO_3 correspond to 12 mol

$n_{r(SO3)}$ = 268,8/22,4
= 12mol

To produce 12 mol of SO_3, 12 mol SO_2 and 6 mol O_2 must have reacted according to the coefficients in the balanced chemical equation. The total number of moles of gas that reacted, is 18 mol
The total volume of the reactants is:
$V = n \times V_m$
$V = 18 \times 22,4$✓
$= 403,2\ dm^3$✓
= 22 N
T = 22 N✓ (6)
[30]

QUESTION 8

8.1 8.1.1 $2KC\ell O_3$ + heat ⟶ $2KC\ell + 3O_2$✓
Decomposition✓ ✓mark if equation is balanced

8.1.2 ✓$2kBr + C\ell_2$ $2kC\ell + Br_2$✓
displacement √√ mark if equation is balanced

8.1.3 $2NO + O_2$ ⟶ $2NO_2$✓
✓ Combination✓ mark if equation is balanced
(3 × 3) (9)

8.2 8.2.1 Very bright white flash (1)

8.2.2 Combination (1)

8.2.3 Basic oxide,✓ because they form an alkaline solution.✓ (2)

8.2.4 Exothermic,✓ because heat is given away✓ (2)

8.2.5 Magnesium oxide (1)

8.2.6 Ca > Mg > Zn (3)

8.3

Reaction	Reactants	Products
$N_2 + 3H_2 \longrightarrow 2NH_3$	$N_2 + H_2$	NH_3
$Cl_2 + NaBr \longrightarrow Br_2 + NaCl$	$Cl_2 + NaBr$	$Br_2 + NaCl$
$CuCO_3 \longrightarrow CuO + CO_2$	$CuCO_3$	$CuO + CO_2$

½ mark each (4)
[23]

QUESTION 9

9.1 9.1.1
- Used for household and industrial heating
- Used as a raw material for making other organic compounds

9.1.2
- Used to clean cement off face brick
- Used to prepare hydrochloric acid
- Used to remove oxide coatings on metals before soldering

(Any 2 × 1)

9.1.3
- Used in firefighting devices
- Used in the production of fizzy drinks
- Produce dry ice

(Any 2 × 1)
(3 × 2) (6)

9.2 9.2.1 Oxygen

9.2.4
- Ammonia
- Nitrogen

(Any 1 × 1)
(2 × 1) (2)
[8]

TOTAL SECTION B: 115
GRAND TOTAL: 150

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