higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE
(Second paper)
NQF LEVEL 3

XX February 2020

This marking guideline consists of 7 pages and 1 graph sheet.

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SECTION A

QUESTION 1

1.1 Hooke's law
1.2 Activation energy
1.3 Ozone
1.4 Gay Lussac's law
1.5 One mole

(5 × 1) **[5]**

QUESTION 2

2.1 E
2.2 I
2.3 C
2.4 A
2.5 D

(5 × 1) **[5]**

QUESTION 3

3.1 False
3.2 True
3.3 True
3.4 False
3.5 True

(5 × 2) **[10]**

QUESTION 4

4.1 D
4.2 A
4.3 D
4.4 C
4.5 B

(5 × 3) **[15]**

TOTAL SECTION A: 35

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SECTION B

QUESTION 5

5.1 5.1.1 Stress is defined as the force per unit area acting on a material.

5.1.2 Strain is defined as the distortion or change in length that takes place due to stress.

(2 × 2) (4)

5.2 5.2.1 Brittle
5.2.2 Stiff material
5.2.3 Malleable
5.2.4 Ductile

(4 × 1) (4)

5.3 5.3.1 NH_3 (2)

5.3.2 The molecule has a permanent dipole/Strong dipole-dipole attraction/Strong hydrogen bonding.✓ There are strong intermolecular forces between the molecules.✓ A large amount of energy is required to separate the molecules during boiling.✓ (3)

5.3.3 B D C✓✓

PH_3 AsH_3 SbH_3 (2)

5.3.4
- Increase in the strength of the Van der Waals forces
- Increase in molecular mass (Any 1 × 2) (2)

[17]

QUESTION 6

6.1
- All gas particles are identical.
- The distance between the molecules is very great/Particles themselves have no volume.
- There are no forces between the molecules except during collision.
- Collisions are perfectly elastic.
- Gas has volume because of the motion of the particles. (Any 3 × 1) (3)

6.2 6.2.1 What is the relationship between the volume of an enclosed gas and its temperature in K when the pressure is kept constant? (2)

6.2.2
- Quantity of gas
- Pressure (Any 1 × 2) (2)

6.2.3 See graph (attached)
(One mark for each point plotted accurately) (4 × 1) (4)

6.2.4 The volume of an enclosed gas is directly proportional to its temperature in K. (2)

6.2.5 There are forces of attraction between real gas particles. (2)

6.3 $PV = nRT$✓

$(101,3)$✓ $V = (1)(8,31)$✓ $(273,15)$✓

$= 22,4\ dm^3$ (4)

[19]

QUESTION 7

7.1 7.1.1 It refers to resistance to flow of a liquid. (2)

7.1.2 Oil (1)

7.1.3
- The molecules in oil are branched and very long. Hence they entangle when oil flows.
- Oil has stronger intermolecular forces. (Any 1 × 2) (2)

7.1.4 As the temperature increases, the viscosity decreases. (2)

7.2 7.2.1 Temperature at which the vapour pressure of a substance is equal to the external (atmospheric) pressure.

7.2.2 Latent heat of vaporisation is the heat energy needed to change 1 kg of a substance from the liquid phase into the gas phase without changing the temperature of that substance.

(2 × 2) (4)

7.3 Heat absorbed by ice to increase its temperature from -10 °C to 0 °C

$= mc\ \Delta t$✓

$= (0,06)\ (2\ 100)\ (10)\ ^\circ C$✓

$= 1\ 260\ J$✓

✓

The heat absorbed by ice = heat lost by water to change from liquid to solid

$2\ 500\ J = L \times m$✓

$= (333\ 000)\ m$

$Mass = 0,003783\ kg$

$= 3,783\ g$✓

(6)

7.4 7.4.1 Decrease (1)

7.4.2 The atmospheric/external pressure decreases (2)

[20]

QUESTION 8

8.1 8.1.1 $S_8 + 12\ O_2 \rightarrow 8\ SO_3$
Reactants✓ Products✓

8.1.2 $3\ Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$
Reactants✓ Products✓

(2 × 2) (4)

8.2 8.2.1 Q
8.2.2 T

(2 × 2) (4)

8.3 8.3.1 Bond energy is the energy required to break one mole of molecules of a compound into separate atoms. (2)

Positive marking from QUESTIONS 8.3.2 to 8.3.4.

8.3.2 Energy required to break the bonds in two moles of hydrogen
= 2(436)
= 873 kJ✓

Energy required to break the bonds in one mole of oxygen
= 498 kJ✓

Total energy required = 873 + 498 = 1 371 kJ✓ (3)

8.3.3 Energy released when 2 moles of water is formed
= 2 (2)✓ (463)✓
= 1 852 kJ✓ (3)

8.3.4 ΔH = Energy intake – Energy given off ✓
= 1 371 – 1 853
= - 482 kJ✓ (2)

8.4 8.4.1 A catalyst is a substance that speeds up the rate of a chemical reaction, but it does not become part of the product. (2)

8.4.2
- A reaction in which there is a net intake on energy
- A reaction for which ΔH is positive
- Reaction in which energy is taken in
- A reaction in which the container gets cold (Any 1 × 2) (2)

8.5 2 mol CO produces 441 kJ energy ✓
0,4 mol CO will produce x

$$x = \frac{(0{,}4)(441)}{2} \checkmark = 88{,}2\ kJ\checkmark$$

(3)
[25]

QUESTION 9

9.1 9.1.1 Relative molar mass of reactants
= 2(201 + 16)✓
= 434✓

Relative molar mass of products
= 2(201) + 2(16)✓
= 434✓

Relative molar mass of reactants = relative molar mass of products (4)

9.1.2 (a) **OPTION 1**

Mass to mass ratio
HgO : Hg
217 : 201✓
10,85 : × ✓

217 × = (10,85)(201)

× = 10,05 g✓

OPTION 2

Mole to mass ratio

$n = \frac{m}{M} = \frac{10,85}{217} = 0,05\ mol$

Mole to mass ratio
HgO : Hg
1 : 201✓
0,05 : × ✓

X = (201)(0,05) = 10,05 g✓ (3)

(b) **OPTION 1**

$n = \frac{m}{M} = \frac{10,85}{217} = 0,05\ mol$✓

Mole to mole ratio

HgO : O_2
2 : 1✓
0,05 : ×

2 × = (1)(0,05)

× = 0,025 mole✓

$n = \frac{V}{V_m}$✓

$0,025 = \frac{V}{24}$

V = 0,6 dm^3 ✓

OPTION 2

Mass to mole ratio

HgO : O_2
434 : 1✓
10,85 : ×✓

434 × = (1)(10,85)

× = 0,025 mole✓

$n = \frac{V}{V_m}$✓

$0,025 = \frac{V}{24}$

V = 0,6 dm^3✓ (5)

9.2	9.2.1	Na_2O		
	9.2.2	$Ca(OH)_2$		
	9.2.3	$NaC\ell$✓ + Br_2✓		
			(3 × 2)	(6)
9.3	9.3.1	Cu^{2+}		(1)
	9.3.2	Displacement/single displacement		(2)
	9.3.3	$Zn_{(s)}$✓ + $CuSO_{4(aq)}$✓ → $ZnSO_{4(aq)}$✓ + $Cu_{(s)}$✓		(4)
				[25]

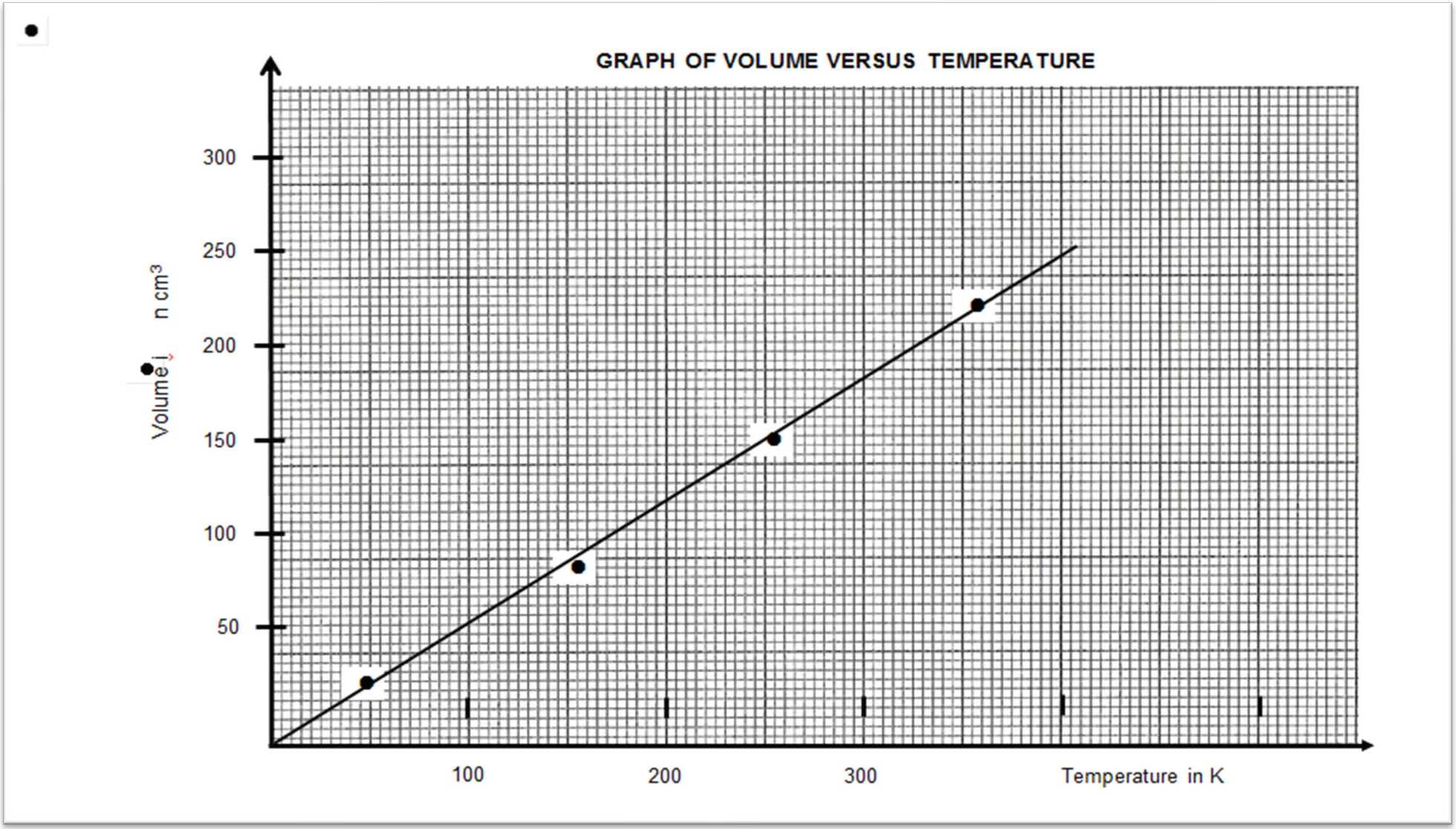
QUESTION 10

10.1	10.1.1	It is the presence of harmful or toxic substances in the air that makes the air dirty.		
	10.1.2	The greenhouse effect is the warming of the earth's atmosphere due to the accumulation of gases such as CO_2 which traps infrared radiation and prevents it to be reflected back to the sun.		
			(2 × 2)	(4)
10.2	10.2.1	CH_4		
	10.2.2	H_2		
	10.2.3	O_2		
	10.2.4	NH_3		
	10.2.5	CO_2		
			(5 × 1)	(5)
				[9]

TOTAL SECTION B: 115
GRAND TOTAL: 150

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QUESTION 6.2.3 (On separate sheet detached from the question paper)



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