higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

MARKING GUIDELINE

NATIONAL CERTIFICATE (VOCATIONAL)

PHYSICAL SCIENCE
(Second Paper)
NQF LEVEL 3

23 NOVEMBER 2017

This marking guideline consists of 7 pages.

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SECTION A

QUESTION 1

1.1 Kinetic theory
1.2 Ductility
1.3 Smog
1.4 Latent heat
1.5 Activation energy

(5 × 1) **[5]**

QUESTION 2

2.1 G
2.2 F
2.3 D
2.4 C
2.5 A

(5 × 1) **[5]**

QUESTION 3

3.1 True
3.2 False
3.3 False
3.4 True
3.5 True

(5 × 2) **[10]**

QUESTION 4

4.1 C
4.2 A
4.3 D
4.4 B
4.5 C

(5 × 3) **[15]**

TOTAL SECTION A: 35

SECTION B

QUESTION 5

5.1 5.1.1 When the balloon is placed in hot water, an increase in temperature increases the average kinetic energy✓ of the gas molecules and the gas molecules move faster✓. As a result the molecules expand and thereby increase the volume✓ of the balloon. (3)

5.1.2 The volume of a gas is directly proportional✓ to the absolute temperature✓ when the pressure and the number of moles are kept constant✓. (3)

5.1.3 Given: $T_1 = 273 + 3$ $T_2 = 273 + 112$

$= 276\ K$ ✓ $= 385\ K$

$V_1 = 2{,}57\ dm^3$ $V_2 = ?$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}\checkmark$$

$$\frac{2{,}57\ dm^3}{276\ K}\checkmark = \frac{V_2}{385\ K}\checkmark$$

$$V_2 = \frac{2{,}57\ dm^3 \times 385\ K}{276\ K}$$

$$= \frac{989{,}45\ dm^3/K}{276\ K}$$

$$= 3{,}58\ K\checkmark$$ (5)

5.2 $pV = nRT$✓

$145\ 250 \times 10 \times 10^{-3}$✓ $= n \times 8{,}31 \times (77 + 273)$✓

$n = 0{,}5\ mol$✓

$m = 0{,}5 \times 32\ g$✓

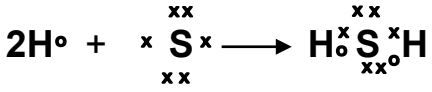
$m = 16\ g$✓ (6)

5.3 5.3.1
- Same group
- Same number of valence electrons
- Same valence (Any 2 × 1) (2)

5.3.2 Covalent bond (2)

5.3.3 An O-H bond is more polar than an S-H bond. (1 + 1) (2)

5.3.4



1 mark for formula 1 mark for 2 lone pairs 1 mark for 2 bonding pairs

(3)

5.3.5 Angular (2)

[28]

QUESTION 6

6.1 6.1.1 Electronegativity is the ability of an atom to attract electrons in a shared pair of electrons. (2)

6.1.2
- Ammonia is a polar molecule.
- Ammonia has strong hydrogen bonds.
- Hydrogen bonds are a strong dipole-dipole interaction between polar molecules containing hydrogen.
- The other hydrides are nonpolar and have weak Van der Waals forces which results in the much higher boiling point of ammonia. (4)

6.1.3 Trigonal pyramidal shape (2)

6.1.4 -3 (2)

6.2 6.2.1 When heated, atoms of solids acquire more energy, begin to vibrate more and tend to occupy more space. (3)

6.2.2 $\Delta L = \alpha L_0 \Delta T$✓
$0{,}096$✓ $= \alpha 40$✓ $\times 80$✓
$\alpha = 0{,}00003\ °C^{-1}$✓ (5)

6.2.3 Latent heat of fusion is the amount of heat energy required to change 1 kg of a solid to a liquid without change of temperature.

Latent heat of vaporisation is the amount of heat energy required to change 1 kg of a liquid to a gas without change of temperature.

(2 + 2) (4)

[22]

QUESTION 7

7.1 7.1.1 $H_2(g)$ ✓+ $F_2(g)$ ✓ → 2HF(g) ✓ (3)

7.1.2 The reaction is exothermic, ΔH is negative. (2)

7.1.3 175 kJ (1)

7.1.4 25 kJ (1)

7.1.5 ΔH = energy of products – energy of reactants
= 25 kJ – 175 kJ✓
= -150 kJ✓ (2)

7.1.6 Activation energy = Activation complex – energy of the reactants
= 300 kJ – 25 kJ
= 275 kJ✓✓ (2)

7.1.7 300 kJ (1)

7.1.8 Combination reaction, since reactants react to form new product different from the original materials. (2)

7.1.9 $H_2(g) + F_2(g) \rightarrow 2HF(g)$✓
2(1) + 2(19) = 2(1 × 19)✓
2 + 38 = 2(20)✓
40 g/mol = 40 g/mol✓ (4)

7.2 7.2.1 Ammonium chloride
7.2.2 Barium nitrate
7.2.3 Sodium carbonate
(3 × 2) (6)
[24]

QUESTION 8

8.1 8.1.1 $2A\ell(s) + 3H_2SO_4(aq) \rightarrow A\ell_2(SO_4)_3(aq)$ ✓ + $3H_2(g)$ ✓

8.1.2 $CH_4(g) + 2O_2(g) \rightarrow CO_2(g)$ ✓ + $2H_2O(\ell)$ ✓

8.1.3 $AgNO_3(aq) + NaC\ell(aq) \rightarrow AgC\ell(aq)$ ✓ + $NaNO_3(aq)$ ✓
(3 × 2) (6)

8.2 8.2.1 Zinc metal begins to dissolve/disappear.✓ A gas is formed.✓ (2)

8.2.2 $Mg(s) + 2HC\ell(aq) \rightarrow MgC\ell_2(aq) + H_2(g)$ (3)

8.2.3 Magnesium✓ > Zinc✓ > Copper✓ (3)

8.2.4 Use a glowing splinter.✓ A pop sound will be heard if its hydrogen.✓ (2)

8.3 8.3.1 A: Decomposition reaction
B: Combination reaction
(2 × 1) (2)

8.3.2 Basic (1)

8.3.3 KOH (2)

8.3.4 $2KC\ell O_3$✓ ⟶ $2KC\ell + 3O_2$✓ bal✓ (3)
[24]

QUESTION 9

9.1 9.1.1
- Metallurgical industry for the manufacture of steel
- In oxy-acetylene torches for welding
- In breathing apparatus (Any TWO)

9.1.2
- Haber process for the manufacture of ammonia
- To provide an inert atmosphere when handling easily oxidisable chemicals
- Carrier gas in vapour-phase chromatography
- Liquid nitrogen used as a cooling agent (Any TWO)

9.1.3
- Haber process for the manufacture of ammonia
- Extraction of metals from their metal oxides
- Manufacture of hydrochloric acid
- Manufacture of organic chemicals
- Manufacture of margarine from vegetable oils
- Liquid hydrogen used as rocket fuel (Any TWO)

(3 × 2) (6)

9.2
- Using low-sulphur fuels to generate power
- Flue gas desulphurisation (FGD)
- Pulverised fluidised bed combustion (PFBC) (3)

9.3 9.3.1 Carbon monoxide is poisonous and it destroys the ability of the blood to absorb oxygen by combining with red blood cells and the victim dies of asphyxia.

9.3.2 Chlorine is a greenish-yellow poisonous gas with an irritating smell.
(2 × 2) (4)

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9.4 9.4.1
- Refrigerants
- Propellants in aerosol sprays (2)

9.4.2 The ozone layer protects the earth from harmful ultraviolet rays. (2)
[17]

TOTAL SECTION B: 115
GRAND TOTAL: 150

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