KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

NATIONAL SENIOR CERTIFICATE

GRADE 11



PHYSICAL SCIENCES P2 (CHEMISTRY)

NOVEMBER 2023

MARKING GUIDELINE

MARKS : 150

TIME : 3 Hours

This marking guideline consists of 7 pages.

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QUESTION 1: MULTIPLE-CHOICE QUESTIONS

1.1 C✓✓
1.2 D✓✓
1.3 B✓✓
1.4 Accept all options✓✓
1.5 D✓✓
1.6 A✓✓
1.7 A✓✓
1.8 C✓✓
1.9 C✓✓
1.10 D✓✓

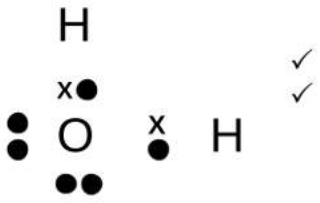


[20]

QUESTION 2

2.1 A pair of electrons in the valence shell of an atom that is not shared with another atom. ✓✓ (2)

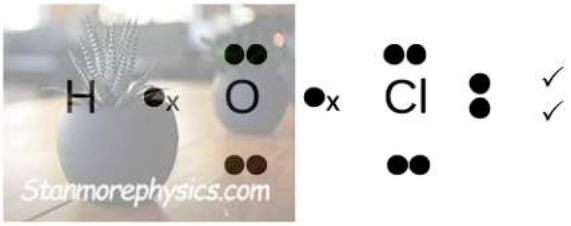
2.2.1



✓
✓

(2)

2.2.2



✓
✓

(2)

2.3.1 2✓ (1)

2.3.2 2✓ (1)

2.4 O-F✓
The difference in electronegativity between O-F is greater than that between O-H / F has a higher electronegativity than H. ✓✓ (3)

2.5 Angular/bent✓ (1)

2.6 D✓ (1)

2.7 NH_3 has polar molecules with hydrogen bonds/dipole-dipole forces and H_2O has polar molecules with hydrogen bonds/dipole-dipole forces. ✓
Forces are of the same order/comparable strengths. ✓

OR

Both molecules are polar / The strengths of the dipoles are of the same order/comparable. ✓
Polar solutes dissolve in polar solvents / Like dissolves in like✓ (2)

2.8 2.8.1 The average distance between the nuclei of two bonded atoms. ✓ ✓ (2)

2.8.2 The N atom is bigger than the H atom, ✓ resulting in a bigger distance between the N and C nuclei. ✓ (2)

2.8.3 3 ✓✓ (2)
[21]

QUESTION 3 (Start on a new page.)

3.1 The temperature at which the vapour pressure of a substance equals atmospheric pressure. ✓✓ (2)

3.2 Boiling point. ✓ (1)

3.3

3.3.1 Dipole- dipole forces ✓ (1)

3.3.2 Hydrogen bonding✓ (1)

3.4 Less than✓ (1)

3.5 Hydrogen bonding between H_2O molecules is stronger than the dipole-dipole forces between H_2S molecules. ✓
More energy is required to overcome the intermolecular forces between water molecules. ✓ (2)

3.6 Greater than✓ Se is a bigger atom than Sulphur✓ (therefore forming a stronger dipole). (2)

3.7 LESS THAN. ✓
NH_3 molecules have one site for hydrogen bonding, while H_2O molecules have two sites for hydrogen bonding. ✓ The intermolecular forces between molecules of NH_3 are weaker✓ than that between molecules of H_2O
Less energy will therefore be required to overcome the intermolecular forces in NH_3. ✓ (4)
[14]

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QUESTION 4 (Start on a new page.)

4.1.1 Boyle's Law✓. The pressure exerted by a fixed quantity of gas is inversely proportional to the volume occupied by the gas✓ at constant temperature. ✓ (3)

4.1.2 Temperature✓
Mass of gas/number of moles of gas✓ (2)

4.1.3 pressure✓ (1)

4.1.4 The gradient of the graph is the product of pressure and volume✓
According to the table the product of pressure and volume is a constant✓
Thus yielding a constant gradient✓ (3)

4.1.5

$p_1V_1 = p_2V_2$ ✓
$(60)(50) = (D)(35)$
$D = 85{,}71\ kPa$ ✓ (2)

4.2

4.2.1 **A**✓ (1)

4.2.2 High pressure ✓✓ (2)

4.2.3 The volume of the molecules of the gas and the intermolecular forces influence the measured value✓
Causing it to be greater than the theoretical value✓
Forces of repulsion between the gas particles prevents them from moving closer. ✓ (3)

[17]

QUESTION 5 (Start on a new page)

5.1 EXOTHERMIC. ✓
The energy of the products is less than the energy of reactants/energy was released✓ (2)

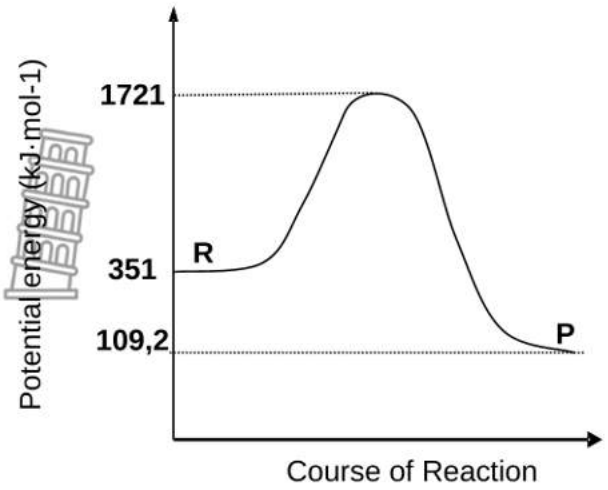
5.2

$\Delta H = H_P - H_R$ ✓
$= 109{,}2 - 351$ ✓
$= -241{,}8\ kJ.mol^{-1}$✓ (3)

5.3 The unstable transition state from reactants to products✓✓ (2)

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5.4



Marking guidelines/*Nasienriglyne:*	
Axes correctly labelled	✓
Energy of Reactants correctly indicated.	✓
Energy of Products correctly indicated.	✓
Energy of Activated complex correctly indicated	✓
Correct shape as shown.	✓

(5)

5.5.1 241,8 kJ.mol^{-1}✓ (1)

5.5.2 1611,8 kJ.mol^{-1}✓✓ (2)

[15]

QUESTION 6

6.1 Simplest (whole number) ratio in which the atoms have combined. ✓✓ (2)

6.2

		N	O	
%		30,4	69,6	
Mass in 100g)		30,4	69,6	
n = $\frac{m}{M}$	✓	$\frac{30,4}{14}$	$\frac{69,6}{16}$	✓
		= 2,17	= 4,35	✓
R		1	2	✓

Empirical formula = NO_2✓

(5)

6.3 N_2O_4✓✓ (2)

[9]

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QUESTION 7

7.1 The reagent that is used up completely in a reaction. ✓✓ (2)

7.2 Calcium carbonate/$CaCO_3$✓✓ (2)

7.3.1

$n(CaCO_3)$ reacted = $(\frac{1}{2})n(HC\ell)$ ✓

= $(\frac{1}{2})(\frac{m}{M})$

= $(\frac{1}{2})(\frac{20-12,7}{36,5})$ ✓✓ ✓

= 0,1 mol

$m(CaCO_3)$ reacted = nM

= (0,1)(100) ✓

= 10g

% purty = $(\frac{10}{12,5})$ x 100✓

= 80 %✓ (7)

7.3.2

$n(CO_2)$produced = $n(CaCO_3)$ ✓

= 0,1 mol

n = $\frac{V}{Vm}$ ✓

0,1 = $\frac{V}{22,4}$ ✓

V = 2,24 dm^3✓ (4)

7.3.3

$n(CaCO_3)$ = $n(H_2O)$ ✓

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

= $\frac{12,6}{18}$ ✓

= 0,7 mol

$m(CaCO_3)$ = nM

= (0,7)(100) ✓

= 70 g

70 = $\frac{80}{100}$ x X ✓

X = 87,5 g✓ (5)

[20]

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QUESTION 8 (Start on a new page.)

8.1.1 An acid is a substance that produces hydrogen ions(H^+)/hydronium ions(H_3O^+) when it dissolves in water. ✓✓ (2)

8.1.2 H_2O✓ and $C_2O_4^{2-}$ ✓ (2)

8.2 HSO_4^- ✓ Acts as a base in step I, ✓ and as an acid in step II✓ (3)

8.3 NO. ✓ The concentration of F^- ions is lower than concentration of HF. ✓
HF Ionises incompletely✓ (3)

8.4 $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$ LHS✓ RHS✓ Balancing✓ (3)

8.5

$$\begin{aligned} n(HBr)initial &= cV✓ \\ &= (0,45)(\frac{90}{1000})✓ \\ &= 0,0405\ mol.dm^{-3} \\ n(HBr)excess &= n(NaOH)\ ✓(ratio) \\ &= cV \\ &= (0,5)(\frac{16,5}{1000})✓ \\ &= 8,25 \times 10^{-3}\ mols \\ n((Zn(OH)_2) &= \frac{1}{2}n(HBr)\ ✓(ratio) \\ &= \frac{1}{2}(\underline{0,0405 - 8,25 \times 10^{-3}})\ ✓✓ \\ &= 0.016125\ mols \\ X = m((Zn(OH)_2) &= nM \\ &= (0.016125)(99)\ ✓ \\ &= 1,596375\ g / 1,6\ g✓ \end{aligned}$$

(9)
[22]

QUESTION 9 (Start on a new page.)

9.1 Oxidation is the loss of electrons✓✓ (2)

9.2.1. Hydrogen sulphide/H_2S/S^{2-}✓ S undergoes an increase in oxidation no.✓ (2)

9.2.2 Potassium permanganate/permanganate ion/$KMnO_4$/MnO_4^-/Mn^{7+}✓ (1)

9.2.3 $\underline{MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O}$ ✓✓ (2)

9.2.4 $\underline{H_2S \rightarrow S + 2H^+ + 2e^-}$✓✓ (2)

9.2.5 $2\ MnO_4^- + 5\ H_2S + 6\ H^+ \rightarrow 2\ Mn^{2+} + 5\ S + 8\ H_2O$ (3)
(LHS ✓; RHS ✓ ; Balanced correctly ✓) **[12]**

TOTAL 150

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