

FINAL



KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

**PROVINCIAL STANDARDISED
ASSESSMENTS**

GRADE 12

PHYSICAL SCIENCES P2 (CHEMISTRY)

PREPARATORY EXAMINATION

MARKING GUIDELINES

SEPTEMBER 2026

MARKS: 150

These marking guidelines consist of 9 pages.

QUESTION 1

1.1	D ✓✓	(2)
1.2	C ✓✓	(2)
1.3	D ✓✓	(2)
1.4	D ✓✓	(2)
1.5	C ✓✓	(2)
1.6	A ✓✓	(2)
1.7	B ✓✓	(2)
1.8	A ✓✓	(2)
1.9	B ✓✓	(2)
1.10	A ✓✓	(2)
		[20]

QUESTION 2

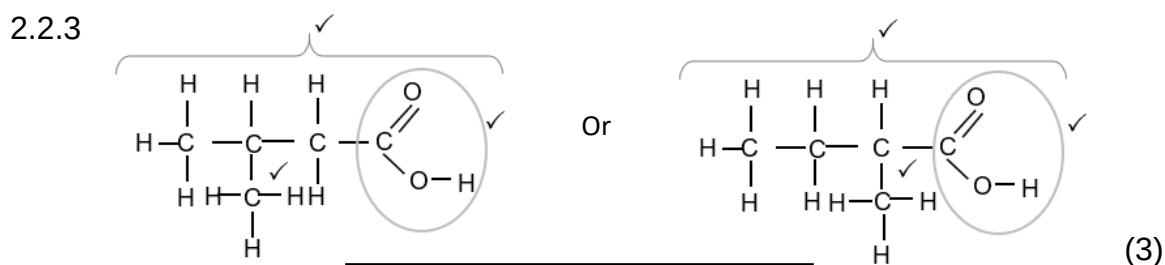
2.1.1 B ✓ (1)

2.1.2 A ✓ (1)

2.1.3 D and F ✓✓ (2 or 0) (2)

2.2.1 2-methylbut-1-ene ✓✓ (2)

2.2.2 Aldehyde ✓ (1)

**Marking criteria**

- Functional group: ✓
- Side chain (methyl) on carbon 2 or 3: ✓
- Whole structure correct: ✓

2.3.1 Combustion ✓ Accept oxidation (1)

2.3.2 $2\text{C}_4\text{H}_{10} + 13\text{O}_2 \rightarrow 8\text{CO}_2 + 10\text{H}_2\text{O}$ ✓ (2)

2.3.3 $\frac{V_{(\text{C}_4\text{H}_{10})}}{V_{(\text{CO}_2)}} = \frac{n_{(\text{C}_4\text{H}_{10})}}{n_{(\text{CO}_2)}}$ ✓

Positive marking from 2.3.2 (for applying the ratio correctly)

$$\frac{V_{(\text{C}_4\text{H}_{10})}}{5} = \frac{2}{8} \quad \checkmark \quad (3)$$

$$V_{(\text{C}_4\text{H}_{10})} = 1,25 \text{ dm}^3 \quad \checkmark$$

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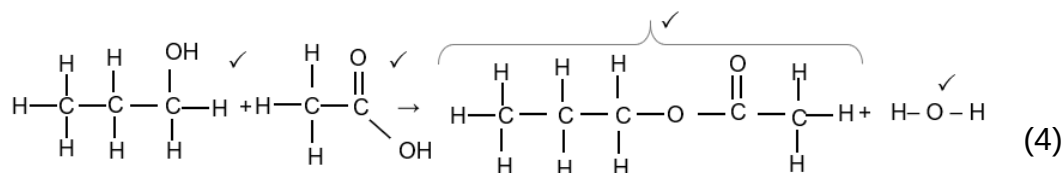
QUESTION 3

- 3.1 The temperature at which the vapour pressure is equal to the atmospheric pressure. ✓✓ (2 or 0) (2)
- 3.2.1 Alkanes ✓ (1)
- 3.2.2
- A, B, and C have London forces ✓ between their molecules.
 - As the molecular mass/Chain length/surface area increases from A to C, so does the strength of the intermolecular forces. ✓
 - The energy needed to overcome the intermolecular forces is the highest in C and lowest in A. ✓ (3)
- 3.2.3 C. ✓
It has the highest Boiling point ✓ as compared to A and B. (2)
- 3.3.1 Molecular formula shows the actual number of each type of atom in a molecule. ✓
Structural formula shows how the atoms are arranged and bonded to one another in a molecule. ✓ (2)
- 3.3.2 Chain ✓ (isomer) (1)
- 3.3.3 Compound C has a greater surface area ✓
(Accept: Compound C has the longer chain length) (1)
- 3.4.1 CH_3CHO ✓ (1)
- 3.4.2 Higher than. ✓ (1)
- 3.4.3
- Compound E has Dipole forces ✓ between its molecules while A has London forces only.
 - Dipole forces in compound E are stronger than the London forces in compound A. ✓
 - More energy is required to overcome the intermolecular forces in compound E than in compound A. ✓ (3)

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QUESTION 4

- 4.1 A haloalkane in which the carbon bonded to the halogen is directly bonded to one other carbon atom. ✓✓ (2)
- 4.2.1 Elimination ✓ or dehydrohalogenation. (1)
- 4.2.2 Heat under reflux. /strong heat✓ (1)
- 4.2.3 $x = 3$ ✓
 $y = 7$ ✓ (2)
- 4.2.4 KBr ✓ and H_2O ✓ (2)
- 4.3.1 Hydration ✓ (1)
- 4.3.2 Propan-1-ol ✓/ 1-Propanol (1)
- 4.3.3 Minor. ✓ (1)
- 4.4.1 Carboxylic acid. ✓ (1)
- 4.4.2

**Marking criteria**

- Propan-1-ol formula correct: ✓
- Ethanoic acid formula correct: ✓
- Propyl ethanoate formula correct: ✓
- Water formula correct: ✓

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QUESTION 5

- 5.1 Exothermic. ✓
Energy is released as heat. ✓ (2)
- 5.2 The reaction has reached completion/HCl has been completely used up. ✓ (1)
- 5.3 The change in the concentration of reactants or products per unit time. ✓✓ (2)
- 5.4 Increases. ✓ (1)
- 5.5
- Increase in surface area ✓
 - The number of reactive sites increases/ More particles of zinc are exposed). ✓
 - More effective collisions occur per unit time. ✓
- (3)

5.6 **Number of moles of H₂ formed:**

$$n = \frac{V}{V_m} = \frac{0,168}{24} \checkmark = 0,007 \text{ mol}$$

Number of moles of Zn used during the reactionRatio H₂: Zn => 1:1

$$n_{\text{Zn}} = n_{\text{H}_2} = 0,007 \text{ mol} \checkmark$$

Mass of Zn that reacted:

$$m = n \cdot M \checkmark = 0,007 \times 65 \checkmark = 0,455 \text{ g}$$

Initial mass of Zn:

$$m = 0,385 + \checkmark 0,455 = 0,84$$

$$Y = 0,84 \checkmark \text{ (grams)}$$

OR

Mol of Zn

$$n = \frac{m}{M} = \frac{0,385}{65} \checkmark = 0,00592 \text{ mol}$$

initial mol of Zn

$$n = 0,007 + 0,00592$$

$$= 0,013 \text{ mol}$$

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

$$0,013 = \frac{m}{65}$$

$$m = 0,845 \text{ g} \quad (6)$$

5.7 Positive marking from 5.6

$$\text{Reaction rate} = - \frac{\Delta m}{\Delta t} = - \frac{0,385 - 0,84 \checkmark}{50 - 0 \checkmark} \quad (3)$$

$$\text{Reaction rate} = 0,0091 \text{ g.s}^{-1} \checkmark$$

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QUESTION 6

6.1 The forward and reverse reactions continue to occur ✓✓ (simultaneously at equal rates, resulting in no net change in the concentrations of the reactants and products). (2)

6.2.1 Forward. ✓
An increase in pressure favours the reaction that proceeds towards fewer moles. ✓ (2)

6.2.2 Remains the same. ✓ (1)

6.3 Marking criteria

- Correct K_c expression. ✓
- Substituting 2nd equilibrium concentrations in K_c expression. ✓
- Number of moles of O₂ at 1st equilibrium. ✓
- Ratio n(SO₂):n(O₂):n(SO₃) = 2:1:2 correct: ✓
- All number of moles at equilibrium are correct, with SO₂ moles' expression given in terms of X: ✓
- Dividing all equilibrium moles by 2: ✓
- Correct substitution of 1st equilibrium concentrations in K_c expression: ✓
- Substitute the calculated K_c value. ✓
- Correct value of X: (X=10 mol) ✓

$$K_c = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 \cdot [\text{O}_2]} \checkmark = \frac{(2,4)^2}{(1,7888)^2 \cdot (1,2)} \checkmark = 1,5$$

	SO ₂ (g)	O ₂ (g)	SO ₃ (g)	
Ratio	2	1	2	
Initial n (mol)	X	6	-	
Change (mol)	<u>6</u>	<u>3</u>	<u>6</u>	Ratio ✓
Equilibrium (mol)	<u>X - 6</u>	<u>3</u> ✓	<u>6</u>	All Equil. n correct ✓
$c = \frac{n}{V}$ (mol.dm ⁻³)	<u>$\frac{X-6}{2}$</u>	1,5	<u>$\frac{6}{2} = 3$</u>	Divide all by 2 ✓

$$K_c = \frac{[\text{SO}_3]^2}{[\text{SO}_2]^2 \cdot [\text{O}_2]} \quad \text{So; } 1,5 \checkmark = \frac{3^2}{\left(\frac{X-6}{2}\right)^2 \times 1,5} \checkmark; \text{ therefore } X = 10 \checkmark \quad (9)$$

6.4.1 When the equilibrium in a closed system is disturbed, the system will re-instate a new equilibrium by favouring the reaction that will oppose the disturbance. ✓✓ (2)

6.4.2

- Exothermic. ✓
- A decrease in temperature favours the Exothermic reaction. ✓
- When K_c increases, the forward reaction is favoured/ More SO₃ is formed. ✓ (3)

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QUESTION 7

7.1 A substance that produces hydroxide ions (OH^-) in aqueous solution/water ✓✓ (2)

7.2 It ionises completely in water ✓. (1)

7.3 $n = cv$ ✓
 $= 0,4 \times 0,0225$ ✓
 $n = 0,009 \text{ mol}$ ✓ (3)

7.4.1 $\text{M}(\text{OH})_2$. ✓
 The solution is acidic ✓ ($\text{pH} < 7$) (2)

7.4.2 Positive marking from 7.3

Marking criteria

- pH formula. ✓
- Substitution in pH formula to calculate $[\text{H}_3\text{O}^+]$. ✓
- Number of moles of HCl in the mixture. ✓
- Number of moles of HCl that reacted: $n_{\text{initial}} - n_{\text{in excess}}$. ✓
- Correct mole ratio: HCl: $\text{M}(\text{OH})_2$ to determine moles of $\text{M}(\text{OH})_2$. ✓
- Multiply by 16 to get the number of moles of $\text{M}(\text{OH})_2$ in 600cm^3 : ✓
- Substitution into formula $m = nM$ to calculate the molar mass of $\text{M}(\text{OH})_2$: ✓
- Calculate the relative atomic mass of **M**. ✓
- Identify that **M** is Barium. ✓

$$\text{pH} = -\log [\text{H}_3\text{O}^+] \checkmark$$

$$1,602 \checkmark = -\log [\text{H}_3\text{O}^+]$$

$$[\text{H}_3\text{O}^+] = 0,025 \text{ mol}\cdot\text{dm}^{-3}.$$

$$n = cv = 0,025 \times (0,0375 + 0,0225) \checkmark = 0,0015 \text{ mol}$$

$$\text{Reacted HCl: } n = 0,009 - 0,0015 \checkmark = 0,0075 \text{ mol}.$$

Ratio: $\text{HCl}:\text{M}(\text{OH})_2$ is 2:1

$$\text{Number of moles of } \text{M}(\text{OH})_2 \text{ in } 37,5 \text{ cm}^3: n = \frac{1}{2} 0,0075 \checkmark = 0,00375 \text{ mol}.$$

$$\text{Number of moles of } \text{M}(\text{OH})_2 \text{ in } 600\text{cm}^3: n = 0,00375 \times 16 \checkmark = \underline{0,06 \text{ mol}}.$$

Molar mass of $\text{M}(\text{OH})_2$:

$$m = nM$$

$$10,26 = 0,06 \times M_r \checkmark$$

$$M_r = 171 \text{ g}\cdot\text{mol}^{-1}.$$

Relative atomic mass of **M**:

$$M + (16 \times 2) + (1 \times 2) = 171$$

$$M = 137 \text{ g}\cdot\text{mol}^{-1} \checkmark$$

M is Barium (Ba) ✓

$$c = \frac{n}{V} = \frac{0,06}{0,6}; c = 0,1 \text{ mol}\cdot\text{dm}^{-3}$$

$$c = \frac{m}{M_r V}; 0,1 = \frac{10,26}{M_r(0,6)} \checkmark$$

$$M_r = 171 \text{ g}\cdot\text{mol}^{-1}.$$

Relative atomic mass of **M**:

$$M + (16 \times 2) + (1 \times 2) = 171$$

$$M = 137 \text{ g}\cdot\text{mol}^{-1} \checkmark$$

M is Barium (Ba) ✓

(9)

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QUESTION 8

8.1 Chemical energy to Electrical energy. ✓ (1)

8.2 To maintain the neutrality of solutions. } Any one ✓
To complete the circuit. (1)

8.3 B ✓ (1)

8.4.1 Sn^{2+} ✓ (1)8.4.2 $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}$ ✓ (2)8.4.3 $\text{C(s)} \mid \text{Sn}^{2+}(\text{aq}), \text{Sn}^{4+}(\text{aq}) \parallel \text{MnO}_4^-(\text{aq}), \text{H}^+(\text{aq}), \text{Mn}^{2+}(\text{aq}) \mid \text{C(s)}$
(Deduct 1 mark if H_2O is shown in the cell notation) (3)8.5 $E^\theta_{\text{cell}} = E^\theta_{\text{cathode}} - E^\theta_{\text{anode}}$ ✓
 $= (+1, 51) - (0, 15)$ ✓
 $= 1.36 \text{ V}$ ✓ (4)

8.6.1 Remains the same. ✓ (1)

8.6.2 Decreases. ✓✓ (2)

[16]**QUESTION 9**

9.1 The chemical process in which electrical energy is converted to chemical energy. ✓✓ (2)

9.2 Endothermic. ✓ (1)

9.3.1 X ✓ (1)

9.3.2 A ✓ Accept B (1)

9.3.3 $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu(s)}$ ✓ (2)

9.4.1 Decreases. ✓ (1)

9.4.2 Chlorine (gas) / Cl_2 ✓ (1)9.4.3 $2\text{Cl}^- \rightarrow \text{Cl}_2(\text{g}) + 2\text{e}^-$ ✓ (2)**[11]****TOTAL: 150**