LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

NATIONAL SENIOR CERTIFICATE

GRADE 12

PHYSICAL SCIENCES PAPER 2

MEMO

PREPARATORY 2025

MARKS: 150

TIME: 3 Hours

This Marking Guidelines consist of 10 pages including the cover page

QUESTION 1

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

QUESTION 2

2.1 Chain isomers are compounds with the same molecular formula but different types of chains. ✓✓ (2)

2.2.1 C✓ (1)

2.2.2 4 – bromo – 2,2 – dimethylpentane✓✓✓ (3)

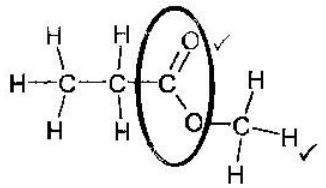
Notes:
1. Bromo, dimethyl identified✓
2. Pentane✓
3. Whole structure correct✓

2.2.3 Pent – 1 – ene✓✓ (2)

Notes:
1. Correct functional group✓
2. Whole structure correct✓

2.2.4 C_nH_{2n}✓ (1)

2.3



(2)

Notes:
1. Correct functional group✓
2. Whole structure correct✓

2.4 $\underline{C_5H_{12} + 8O_2}$✓ → $\underline{5CO_2 + 6H_2O}$✓ (✓balance) (3)

2.5 Aldehydes✓ (1)

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2.6 $20\%\ C - atoms\ in\ comp.\ C = \frac{20}{100} \times 5$✓

$= 1$✓

Compound E has 6 C – atoms

∴ x = 6✓ and y = 14✓ **OR** (x = 6✓✓ and y = 14✓✓) (4)

[19]

QUESTION 3

3.1 Melting point is the temperature at which the solid and the liquid phases of a substance are at equilibrium. ✓✓ (2)

3.2 As the chain length/molar mass/number of carbon atoms increases, the boiling/melting point increases. ✓✓ (2)

3.3 Stronger than. ✓ (1)

3.4 Fair. ✓The compounds belong to the same homologous/intermolecular force/functional group/there is only one independent variable.✓ (2)

3.5 Gas. ✓ (1)

3.6
- Propane has a longer chain length/larger/ surface area/ bigger molecular size/more carbon atoms than ethane.✓
- Both have London forces/dispersion/dipole-dipole which are <u>stronger between propane molecules than in ethane</u>.✓/the intermolecular forces of propane are stronger
- More energy is needed to overcome the intermolecular force in propane than in ethane.✓

OR

- Ethane has shorter chain length/smaller surface area/smaller molecular size/less carbon atoms than propane.✓
- Both have London forces/dispersion/dipole-dipole which are <u>weaker between ethane molecules than in propane</u>.✓
- Less energy in needed to overcome the intermolecular forces in ethane than in propane.✓ (3)

[11]

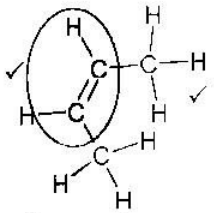
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QUESTION 4

4.1.1 Substitution/hydrolysis✓ (1)

4.1.2 Butan – 2 – ol✓✓ Accept 2-butanol (1 mark for butanol, 1 mark for position) (2)

4.2.1



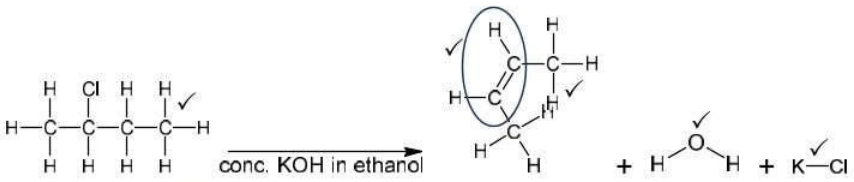
Notes:

1. Correct functional group✓
2. Whole structure correct✓

(2)

4.2.2 (Strong) Heat✓ (1)

4.3.1



(5)

4.3.2 **Positive marking form 4.3.1**
But-2-ene.✓✓ /Accept 2-Butene (1 mark for butene, 1 mark for position) (2)

4.4.1 Addition/hydrogenation.✓ (1)

4.4.2 Ni/Pt/Pd/Nickel/Platinum/Palladium.✓ (1)

4.5.1 Cracking is the chemical process in which longer chain hydrocarbon molecules are broken down to shorter more useful molecules.✓✓ (2)

4.5.2 Catalyst (Pt, Pd and Ni).✓ (1)

[18]

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QUESTION 5

5.1 Rate of reaction is the change in concentration of reactants or products per unit time.✓✓ (2)

5.2 Neutralisation reaction.✓/Acid-base reaction (1)

5.3 State of division/surface area.✓ (1)

5.4 Rate of reaction.✓ (1)

5.5 $n(CO_2) = \frac{V}{V_m}$✓

$= \frac{53}{22\,400}$✓

$= 0{,}002366 \text{ mol}$

$n(HCl) = \frac{2(0{,}002366)}{22\,400}$✓

$= 0{,}004732\ mol$

$Rate = \frac{\Delta n}{\Delta t}$✓

$= \frac{0{,}004732}{60}$✓

$= 0{,}0000789\ mol.s^{-1}/(7{,}89 \times 10^{-5} mol.s^{-1})$✓ (5)

[10]

QUESTION 6

6.1.1 Chemical equilibrium is a dynamic equilibrium when the rate of the forward reaction equals to the rate of the reverse reaction.✓✓ (2)

6.1.2

	SO_2	O_2	SO_3	
Ratio	2	1	2	
Initial amount(mol)	$\mathbf{x}$	0,5	0	
Change	-0,75	-0,375✓	0,75	✓Ratio
Equilibrium	$\mathbf{x - 0,75}$	0,125✓	0,75	
Concentration	$\frac{\mathbf{x - 0,75}}{\mathbf{2}}$	0,0625	0,375	✓ ÷ 2

$$\mathbf{K_c = \frac{[SO_3]^2}{[SO_2]^2[O_2]}}\checkmark$$

$$\mathbf{10}\checkmark = \frac{(0,375)^2}{\left(\frac{x-0,75}{2}\right)^2(0,0625)}\checkmark$$

$$\mathbf{x = 1,70\ mol}\checkmark$$

(8)

6.1.3 **Positive marking from 6.1.2**

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

$$\mathbf{1,70 = \frac{m}{64}}\checkmark$$

$$\mathbf{\therefore\ m = 108,8g}\checkmark$$

(3)

6.2.1 Decreases.✓ (1)

6.2.2 Stays the same.✓ (1)

6.2.3 Decreases.✓ A decrease in pressure favours the reaction that produces more moles of gas/more volume.✓The reverse reaction is favoured.✓ (3)

[18]

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QUESTION 7

7.1 A weak base is a base that ionises/dissociates incompletely in water to form a low concentration of hydroxide ions.✓✓ (2)

7.2 **Option 1:**

$[H_3O^+] = 2 \times 0,02$✓ $= 0,04$ $mol.dm^{-3}$

$K_w = [H_3O^+][OH^-]$✓

$1 \times 10^{-14} = 0,04\ [OH^-]$✓ $[OH^-] = 2,5 \times 10^{-13}$ $mol.dm^{-3}$✓

Option 2:

$pH = -log[H_3O^+]$✓

$= -log(0,04)$ ✓

$= 1,398$

$pH + pOH = 14$

$1,398 + pOH = 14$✓

$pOH = 12,602$

$pOH = -log[OH^-]$

$12,602 = -log[OH^-]$

$[OH^-] = 2,50 \times 10^{-13} mol.dm^{-3}$✓

(4)

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7.3.1 $n(H_2SO_4) = cv$✓

$= (0{,}02)(0{,}025)$✓

$= 0{,}0005\ mol$

$n(NH_3) = 2(0{,}0005)$✓

$= 0{,}001\ mol$

$[NH_3]\ in\ diluted\ solution = \frac{c}{V}$

$= \frac{0{,}001}{0{,}0312}$✓

$= m0{,}032051\ mol$

n(NH_3) in 250 cm^3 = cv

$= 0{,}032051\ x\ 0{,}25$✓

$= 0{,}0080128\ mol$

n(NH_3) in 250 cm^3 = $n(NH3)\ in\ 20\ cm3\ of\ undiluted\ solution$

$[NH_3] = \frac{n}{V}$

$= \frac{0{,}080128}{0{,}02}$✓

$= 0{,}4\ mol.dm^{-3}$✓

(7)

7.3.2 Below 7✓

$NH_4^+ + H_2O$✓ ⟶ $NH_3 + H_3O^+$✓✓ (4)

7.4.1 An Ampholyte is a substance that can act as either an acid or a base✓✓ (2)

7.4.2 $HC_2O_4^-$✓ (1)

7.4.3 $H_2C_2O_4$✓ and H_3O^+✓ (2)

[22]

QUESTION 8

8.1 A galvanic cell is a cell in which chemical energy is converted to electrical energy.✓✓ (2)

8.2 Concentration of 1mol.dm^{-3}✓

Temperature of 25^{0}C/298K✓ (2)

8.3.1 Pt✓ (1)

8.3.2 Cr✓ (1)

8.4 2 mol.dm^{-3}✓ (2)

8.5 $3Sn^{4+} + 2Cr$✓ $\longrightarrow$ $3Sn^{2+} + 2Cr^{3+}$✓ (✓balancing) (3)

8.6 $E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$✓

$= +0,15$✓$- (-0,74)$✓

$= +0,89V$✓ (4)

8.7 Decreases.✓ (1)

[16]

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QUESTION 9

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

9.2 $Cu \longrightarrow Cu^{2+} + 2e^-$ ✓✓

Notes/*Notas*: Ignore phases/*ignoreer fases*	
$Cu^{2+} + 2e^- \leftarrow Cu$ (2/2)	$Cu^{2+} + 2e^- \leftrightarrow Cu$ (0/2)
$Cu \leftrightarrow Cu^{2+} + 2e^-$ (1/2)	$Cu^{2+} + 2e^- \rightarrow Cu$ (0/2)

(2)

9.3 Impure copper.✓ (1)

9.4.1 Zinc/Nickel/Zn/Ni.✓ (1)

9.4.2 Zinc/Nickel is a stronger reducing agent✓ than copper.✓ (2)

9.4.3 They will fall to the bottom.✓ (1)

9.5

$$\boldsymbol{mass\ of\ copper + impurutues = 600 - 390}\checkmark$$

$$\boldsymbol{= 210g}$$

$$\boldsymbol{mass\ of\ pure\ copper = 320 - 150}\checkmark$$

$$\boldsymbol{= 170g}$$

$$\boldsymbol{\%\ purity = \frac{170}{210} \times 100}\checkmark$$

$$\boldsymbol{= 80,95\%}\checkmark$$

(4)

9.6 It remains constant.✓The rate of oxidation of copper is equal to the rate of reduction of copper ions.✓✓ (3)

[16]

TOTAL: 150

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