FINAL

KWAZULU-NATAL PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

GRADE 12

NATIONAL SENIOR CERTIFICATE

PHYSICAL SCIENCES P2 (CHEMISTRY)

PREPARATORY EXAMINATION

SEPTEMBER 2025

MARKING GUIDELINES

MARKS: 150

This marking guideline consists of 11 pages.

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QUESTION 1

1.1 B ✓✓ (2)

1.2 D ✓✓ (2)

1.3 C ✓✓ (2)

1.4 C ✓✓ (2)

1.5 C ✓✓ (2)

1.6 C ✓✓ (2)

1.7 D ✓✓ (2)

1.8 C ✓✓ (2)

1.9 D ✓✓ **DO NOT MARK** (2)

1.10 B ✓✓ (2)

[20]

QUESTION 2

2.1.1 4 – bromo – 5 – ethyl – 2 - methylheptane✓✓✓

Marking criteria:
- correct stem i.e. heptane ✓
- substituents correctly identified i.e. bromo, ethyl, methyl✓
- IUPAC name completely correct including numbering, sequence and hyphen ✓

(3)

2.1.2 3 – methylbut – 1 - ene✓✓

Marking criteria:
- correct stem and substituents i.e. dibromo, methyl and heptane✓
- IUPAC name completely correct including numbering, sequence and hyphen ✓

(2)

2.2 $C_nH_{2n}O_2$✓ (1)

2.3.1 E✓ (1)

2.3.2 C✓ (1)

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2.4.1 Compounds with the same molecular formula, ✓ but different functional groups/homologous series.✓

Marking criteria:
If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark. (2)

2.4.2 $C_5H_{10}O_2$✓✓ (2)

2.4.3 Pentanoic acid or methylbutanoic acid✓✓

Marking criteria:
- correct homologous series: carboxylic acid. ✓
- IUPAC name completely correct. ✓

(2)
[14]

QUESTION 3

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

Marking criteria:
If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark.
The underlined phrases must be in the correct context. (2)

3.2.1 Ensure a fair test/comparison. ✓ (1)

3.2.2 London forces/Dispersion forces. ✓ (1)

3.2.3 Hydrogen bonding ✓ (1)

3.4 Y. ✓
Y has the lowest boiling point. ✓
Or Y has the lowest intermolecular forces compared to W and X. (2)

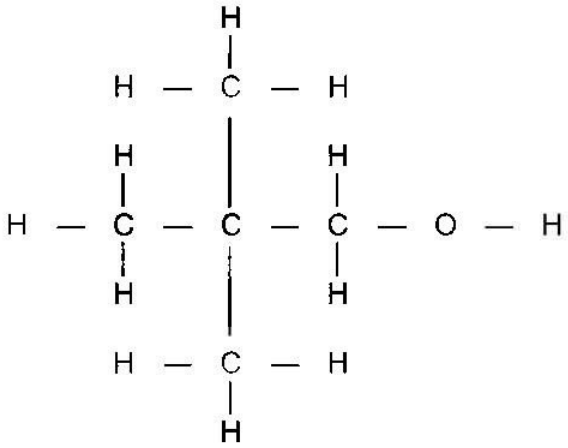
3.5

Marking criteria:
- Relate boiling point with length of carbon chain/branching/number of side chains/surface area. ✓✓
- Compare the strength of the intermolecular forces. ✓
- Compare the energy required to overcome the intermolecular forces. ✓

X has the lowest boiling point ✓ and therefore has the shorter carbon chain/is branched/more compact/more spherical/smaller surface area over which the intermolecular forces act than W.✓
Weaker intermolecular forces/Van der Waals forces/London forces than W.✓
Less energy needed to overcome the intermolecular forces✓ OR (4)

W has the higher boiling point ✓ and therefore has the longer carbon chain/no branches/less compact/less spherical/largest surface area over which the intermolecular forces act than X.✓
Stronger/more intermolecular forces/Van der Waals forces/London forces than X✓
More energy needed to overcome the intermolecular forces✓

3.6



Marking criteria:
- Functional group on first carbon✓
- 3 carbons in the longest chain ✓
- 2 – methyl groups on the second carbon ✓

(3)

3.7

Marking criteria:
- LOWER THAN ✓
- Correctly identify intermolecular forces in both compounds. ✓
- Compare the strength of the intermolecular forces. ✓
- Compare the energy required to overcome the intermolecular forces. ✓

LOWER THAN✓
2,2 – dimethylpropane has only London/Dispersion forces between molecules and Compound Y has hydrogen bonds✓ and dipole-dipole forces in addition to London/Dispersion forces
Intermolecular forces between molecules of 2,2 – dimethylpropane are weaker✓
Require less energy to overcome. ✓

(4)
[18]

QUESTION 4

4.1 addition✓ (1)

4.2 The C-atom bonded to the hydroxyl/-OH✓ is bonded to three other carbon atoms.✓

Marking criteria:

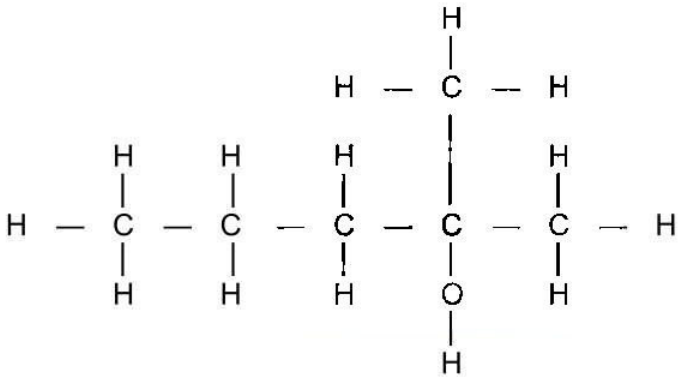
If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark.
The underlined phrases must be in the correct context.

(2)

4.3.1 Water/H_2O✓ (1)

4.3.2 Sulphuric acid/H_2SO_4 or Phosphoric acid/H_3PO_4✓ (1)

4.4.1



Marking criteria:

- Correct functional group✓
- substituent correctly identified i.e. methyl✓
- IUPAC name completely correct including numbering, sequence and hyphen ✓

(3)

4.4.2 2 – methyl – 1 - bromopentane✓✓✓

Marking criteria:

- correct stem i.e. pentane ✓
- substituents correctly identified i.e. bromo, methyl✓
- IUPAC name completely correct including numbering, sequence and hyphen ✓

(3)

4.5.1 hydroxyl✓ (1)

4.5.2 substitution✓ (1)

4.5.3 Dilute KOH/potassium hydroxide✓ (1)

4.5.4 $C_6H_{13}Br + KOH \rightarrow C_6H_{14}O + KBr$

Marking criteria:
- Both reactants correct. ✓
- Both products correct✓
- Balancing ✓

(3)
[17]

QUESTION 5

5.1 The CO_2 produced escapes from the container. ✓ (1)

5.2
- Change in concentration ✓ of products/reactants per (unit) time. ✓
- Change in amount/number of moles/volume/mass ✓ of products/reactants per (unit) time. ✓
- Amount/number of moles/volume/mass of products formed/reactants used per (unit) time. ✓✓

Marking criteria:

If any one of the underlined key words/phrases in the **correct context** is omitted, deduct 1 mark.
The underlined phrases must be in the correct context.

- Rate of change in concentration/amount/number of moles/volume/mass. ✓✓ (**2 or 0**) (2)

5.3
- Reaction is complete/no more CO_2 is produced/$CaCO_3$ is used up✓✓ (2)

5.4
- Crush the calcium carbonate chips to a powder. ✓
- Add a catalyst. ✓ (2)

5.5 **Marking criteria:**

- Correct substitution ($\frac{62,25}{100}$) in the formula $n = \frac{m}{M}$ to calculate n($CaCO_3$) ✓
- Ratio: n($CaCO_3$) used equals n(CO_2) produced ✓
- Use $n = \frac{m}{M}$ to calculate m(CO_2) ✓
- Substitute for both n and M correctly i.e.: n = 0,6225 and M = 44✓
- Rate formula: rate $= \frac{\Delta m}{\Delta t}$ ✓
- Correct substitution for 1,37 for rate✓
- Correct substitution for Δm in the formula: rate $= \frac{\Delta m}{\Delta t}$✓
- Final answer Δt = 19,99 minutes✓

$n(CO_2)$ lost = $n(CaCO_3)$ reacted ✓

$= \frac{m}{M}$ ✓

$= \frac{62,25}{100}$ ✓

$= 0,6225$ mols

$m(CO_2)$ lost = nM

$= (0,6225)(44)$ ✓

$= 27,39$ g

rate = $\frac{\Delta m}{\Delta t}$ ✓

1,37✓ = $\frac{27,39}{\Delta t}$ ✓

Δt = 19,99 minutes✓

(8)

5.6.1 INCREASES.✓ (1)

5.6.2 REMAINS THE SAME✓
$CaCO_3$ is the limiting reagent✓ (2)

5.7
- More reacting molecules per unit volume. ✓
- More molecules correctly orientated. ✓
- More effective collisions per unit time/second. ✓
  OR
- Frequency of effective collisions increases. (3)

[21]

QUESTION 6

6.1 Add more reactants/increase the amount/mols/concentration of the reactants. ✓
OR
Remove some of the products/ decrease the amount/mols/concentration of the products.
OR
Decrease in pressure (1)

6.2

Marking criteria:

- Correctly calculate 70,59% of 5 = 3,53✓
- Using the correct mol ratio✓
- Calculating the quantity(mol) at equilibrium of all three substances ✓
- Using the concentration of Q_2 at equilibrium and the number of mols of A_2 at equilibrium in the equation c = n/Vto calculate the volume of the container. ✓✓
- Calculating the equilibrium concentrations of the reactants✓
- K_c expression✓
- Correct substitution of equilibrium concentrations into K_c expression ✓
- Kc = 5,09 ✓

	A_2Q	A_2	Q_2	
Initial quantity (mol)	5	0	0	
Change (mol)	3,53✓	3,53	1,765	✓
Quantity at equilibrium (mol)	1,47	3,53	1,765	✓
Equilibrium concentration ($mol.dm^{-3}$)	0,735	1,765	0,8825	✓

$$c = \frac{n}{V} \quad ✓$$

$$0,8825 = \frac{1,765}{V} \quad ✓$$

$$V = 2\ dm^3$$

$$K_c = \frac{[A_2]^2[Q_2]}{[A_2Q]^2} \quad ✓$$

$$= \frac{(1,765)^2(0,8825)}{(0,735)^2} \quad ✓$$

$$= 5,09 \quad ✓$$

(9)

6.3 The rates of the forward and reverse reaction do not increase equally. ✓ (1)

6.4

Marking criteria:

If any one of the underlined key words/phrases in the correct context is omitted, deduct 1 mark.
The underlined phrase must be in the correct context.

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)

6.5 GREATER THAN ✓ (1)

6.6 The rate of the forward reaction decreases less than the rate of the reverse reaction. ✓
The forward reaction is favoured. ✓
Concentration of the products increases while the concentration of the reactants decreases. ✓ (3)
[17]

QUESTION 7

7.1.1 CH_3COO^-✓ (1)

7.1.2 GREATER THAN 7✓ (1)

7.1.3 $CH_3COO^- + H_2O \rightarrow CH_3COOH + OH^-$
LHS✓
RHS✓
Balancing✓ (3)

7.2.1 It is a substance that ionises completely ✓ in water to produce a high concentration of hydronium ions. ✓ (2)

7.2.2

Marking criteria:
- Calculate $n(HC\ell)_{excess}$ ✓
- Substitute for c and V in n = cV ✓
- Ratio $HC\ell : Na_2CO_3 = 2:1$✓
- Substitute for c and V ✓
- Calculate $n(HC\ell)_{total}$ by adding above 2 values✓
- Ratio of $c(HC\ell) = c(H_3O^+)$✓
- Substitute into c = n/V to calculate concentration of H_3O^+✓
- Equation: pH = - log$[H_3O^+]$✓
- Substitute into pH = - log$[H_3O^+]$ ✓
- Final answer✓

$n(HC\ell)_{excess} = cV$ ✓
$= (0,013)(0,075)$ ✓
$= 0,000975$ mols

$n(HC\ell)$ reacted with $Na_2CO_3 = 2cV$ ✓
$= (2)(0,075)(0,025)$ ✓
$= 0,00375$ mols

$n(HC\ell)_{total} = 0,000975 + 0,00375$✓
$= 0,004725$ mols

$c(H_3O^+) = c(HC\ell)$ ✓
$= \frac{n}{V}$
$= \frac{0,004725}{0,05}$ ✓
$= 0,0945$ mol.dm^{-3}

$pH = -\log[H_3O^+]$✓
$= -\log 0,0945$✓
$= 1,02$✓

(10)

[17]

QUESTION 8

8.1 Pt✓ (1)

8.2 Remain the same. ✓ (1)

8.3.1 $H_2 \rightarrow 2H^+ + 2e^-$ ✓✓

Notes
- **Ignore phases**
- $H_2 \leftarrow 2H^+ + 2e^-$ $(0/2)$ $2H^+ + 2e^- \rightleftharpoons H_2$ $(0/2)$
  $H_2 \rightleftharpoons 2H^+ + 2e^-$ $(1/2)$

Ignore if charge on electron omitted.

(2)

8.3.2 25°C/298 K ✓ (1)

8.3.3 1 mol.dm^{-3} ✓ (1)

8.4 Cu^{2+} ✓ (1)

8.5 $\underline{Pt(s)/H_2(g)/H^+(aq)(1\ mol.dm^{-3})}$ ✓ // ✓ $\underline{Cu^{2+}(aq)(1\ mol.dm^{-3})/Cu(s)}$ ✓ (3)
Ignore the phases and concentrations

8.6

Notes
- Accept any other correct formula from the data sheet.

Any other formula using unconventional abbreviations, e.g. $E°_{cell} = E°_{OA} - E°_{RA}$ followed by correct substitutions Max: $\frac{3}{4}$

E^{θ}_{cell} = $E^{\theta}_{reduction}$ - $E^{\theta}_{oxidation}$ ✓
0,75 ✓ = 0,34 ✓ - $E^{\theta}_{oxidation}$
$E^{\theta}_{oxidation}$ = - 0,41 V ✓
Yes✓, Cr^{2+} is not a solid. ✓ (6)

[16]

QUESTION 9

9.1 Electrolytic✓
They both have a power supply✓
Both cells converts electrical energy to chemical energy. (2)

9.2 An electrolyte is a substance of which the aqueous solution contains ions.✓✓
OR
A substance that dissolves in water to give a solution that conducts electricity. (2)

9.3 $2H_2O + 2e^- \rightarrow H_2 + 2OH^-$✓✓
Ignore phases

Notes
- $2H_2O + 2e^- \leftrightharpoons H_2 + 2OH^-$ (1/2)
- $H_2 + 2OH^- \leftarrow 2H_2O + 2e^-$ (2/2)
- $H_2 + 2OH^- \leftrightharpoons 2H_2O + 2e^-$ (0/2)
- $2H_2O + 2e^- \leftarrow H_2 + 2OH^-$ (0/2)

(2)

9.4 Cu or Copper✓ (1)

9.5 Decreases✓

Cu^{2+} (or Copper(II) ions) are reduced✓ to Cu ✓ (or Copper). (3)

[10]

TOTAL: 150

NB: MARK SCRIPT OUT OF 148 AND THEREAFTER CONVERT TO TOTAL MARKS : 150

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