



KWAZULU-NATAL PROVINCE

EDUCATION
REPUBLIC OF SOUTH AFRICA

GRADE 12

**NATIONAL
SENIOR CERTIFICATE**

PHYSICAL SCIENCES P2 (CHEMISTRY)

COMMON TEST

JUNE 2024

MEMORANDUM FINAL

MARKS: 100



Testpapers.co.za

Past exam papers

Summaries

Study Guides

QUESTION 1

- 1.1 C ✓✓ (2)
- 1.2 B ✓✓ (2)
- 1.3 B ✓✓ (2)
- 1.4 A ✓✓ (2)
- 1.5 B ✓✓ (2)
- 1.6 D ✓✓ (2)
- [12]**

QUESTION 2

- 2.1.1 2 – methylbutan – 2 – ol ✓✓

Marking criteria:

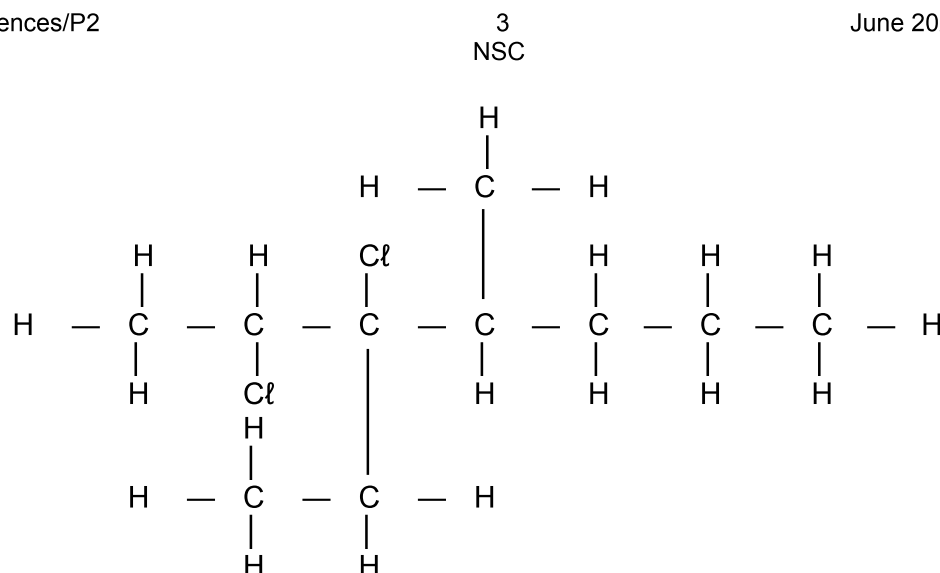
- correct stem i.e. butanol ✓
- IUPAC name completely correct including numbering, sequence and hyphen ✓

(2)

- 2.1.2 **DO NOT MARK**

- 2.2 Tertiary. ✓
The hydroxyl group/OH ✓ is bonded to a carbon that is bonded to 3 other carbon atoms/tertiary carbon. ✓ (3)

2.3.1

**Marking criteria:**

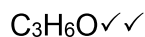
- Seven C atoms in longest chain. ✓
- Cl on second and third carbon atoms, Ethyl substituent on third carbon and methyl substituent on fourth carbon. ✓
- Everything else correct ✓

(3)

2.3.2

Marking criteria:

- The elements C, H and O. ✓
- The correct ratio of the elements 3:6:1. ✓



(2)

CONVERSION TABLE

0	1	2	3	4	5	6	7	8	9	10
0	1	2	4	5	6	7	8	10	11	12

[12]**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

NOTE: If "temperature" is not referred to, then 0/2.

(2)

3.2

A ✓

A has a lower boiling point. ✓

(2)

3.3.1

Boiling point ✓

(1)

3.3.2 Homologous series/functional group/type of intermolecular force✓ (1)

3.4

Marking criteria:

- Identify intermolecular forces in A ✓ and in B. ✓
- Compare the strength of the intermolecular forces✓ and
- Compare the energy required to overcome the intermolecular ✓ forces. ✓
- Compare boiling points. ✓

- Intermolecular forces between molecules of A are dipole-dipole✓ and between molecules of B hydrogen bonding.✓
- The intermolecular forces are stronger in B than that in A / Hydrogen bonding is stronger than dipole-dipole forces ✓
- More energy is required to overcome the intermolecular forces in B. ✓
- B has a higher boiling point than A.✓ *[If this is not stated, and the explanation is correct, award this mark to any of the preceding bullets]*

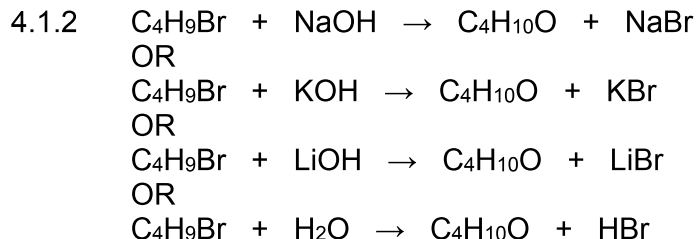
(5)

3.5.1 Higher than✓ (1)

3.5.2 Lower than✓ (1)
[13]

QUESTION 4

4.1.1 Substitution✓ (1)



Marking criteria:

- Both reactants✓
- Both products✓
- Balancing ✓

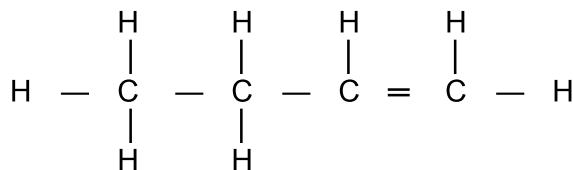
NOTE: Accept if $\text{C}_4\text{H}_9\text{OH}$ is given instead of $\text{C}_4\text{H}_{10}\text{O}$

(3)

4.2 Addition/hydration ✓ (1)

4.3.1 alkenes✓ (1)

4.3.2



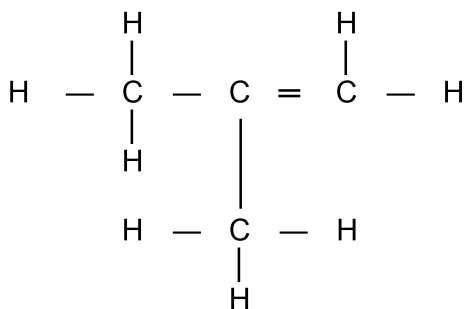
Marking criteria:

- double bond between the first and second carbon ✓
- Whole structure correct ✓

NOTE: If correct structure given for but-2-ene: $1/2$

(2)

4.3.3



Marking criteria for structural formula:

- 3 carbon atoms in longest chain. ✓
- Methyl substituent and double bond. ✓
- Whole structure correct ✓

The molecular formula is the same, ✓ but the isomer is branched/ length of the
(parent) carbon chain is different. ✓

(5)

4.4 Ethanoic acid✓

(1)

[14]

QUESTION 5

5.1.1

- Change in concentration ✓ of products/reactants per (unit) time. ✓ OR
- Change in amount/number of moles/volume/mass ✓ of products/reactants per (unit) time. ✓ OR
- Amount/number of moles/volume/mass of products formed/reactants used ✓_per (unit) time. ✓ OR
- Rate of change of concentration/amount/no. of moles/volume/mass. ✓✓
(2 or 0)

(2)

5.1.2 The HCl is the limiting reagent/reactant / Mg is the excess reagent✓

(1)

5.1.3 **Marking criteria:**

- Substitute 15 in $\frac{\Delta(V(H_2))}{\Delta t}$ ✓
- Substitute 12 in $\frac{\Delta(V(H_2))}{\Delta t}$ ✓
- Substitute V and V_m in $\frac{V}{V_m}$ ✓✓
- Correct Ratio of HCl to H_2 ✓
- Equation $c = \frac{n}{V}$ ✓
- Substitute for n and V in the above equation ✓
- Final answer $0,023 \text{ mol.dm}^{-3}$ ✓

$$\begin{aligned}
 \text{rate} &= \frac{\text{change in volume of } H_2(g)}{\Delta t} \\
 15 \checkmark &= \frac{\Delta(V(H_2))}{12 \checkmark} \\
 \Delta(V(H_2)) &= 180 \text{ cm}^3 \\
 &= 0,18 \text{ dm}^3 \\
 n(H_2)_{\text{produced}} &= \frac{V}{V_m} \\
 &= \frac{0,18}{26,49} \checkmark \\
 &= 6,795 \times 10^{-3} \text{ mols} \\
 n(HCl) &= 2n(H_2) \checkmark \\
 &= 2(6,795 \times 10^{-3}) \\
 &= 0,01359 \text{ mol} \\
 c(HCl) &= \frac{n}{V} \checkmark \\
 &= \frac{0,01359}{0,6} \checkmark \\
 &= 0,02265 \text{ mol.dm}^{-3} \checkmark
 \end{aligned}$$

(8)

5.2.1 REMAINS THE SAME ✓ (1)

5.2.2 Powdered magnesium increases the surface area but mass remains the same ✓
 The rate of the reaction increases. ✓
 HCl is the limiting reagent / Mg is the excess reagent. ✓
 The number of effective collisions remains constant / The number of effective collisions per unit time increases ✓

(4)
[16]

QUESTION 6

- 6.1.1 The rate of the forward reaction equals the rate of the reverse reaction.
OR The amount/concentration of reactants and products remain constant. ✓✓ (2)

6.1.2

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)

6.1.3 EXOTHERMIC. ✓

- Reaction rate decreased/Temperature decreased. ✓
 - Concentration of products increased/concentration of reactants decreased / Forward reaction favoured / According to Le Chatelier's principle a decrease in temperature favours the exothermic reaction. ✓
- (3)

6.2

Marking criteria:

- (a) Calculating initial number of moles of reactants. ✓
 (b) Changing equilibrium concentration to equilibrium moles for O₂, and equilibrium moles to equilibrium concentrations for NO and NO₂. ✓
 (c) Calculating Δ moles of O₂ (0,375 mol), and equilibrium moles of NO and NO₂. ✓
 (d) Apply ratio 2:1:2 to calculate change in number of moles of NO and NO₂. ✓
 (e) K_c expression ✓
 (f) Correct substitution of K_c in expression ✓
 (g) Correct substitution of equilibrium concentrations into K_c expression ✓
 (h) Final answer 2,6 mols ✓

OPTION 1	NO	O ₂	NO ₂	
Initial quantity (mol)	4	2,5	x	
Change (mol)	0,75	0,375	0,75	✓
Quantity at equilibrium (mol)	3,25	2,125	x + 0,75	✓
Equilibrium concentration (mol.dm ⁻³)	6,5	4,25	$\frac{x + 0,75}{0,5}$	✓

$$K_c = \frac{[NO_2]^2}{[NO]^2[O_2]} \checkmark$$

$$\therefore 0,25 \checkmark = \frac{\left[\frac{x+0,75}{0,5}\right]^2}{(6,5)^2(4,25)} \checkmark$$

$$x = 2,6 \text{ mols } \checkmark$$

No K_c expression, correct substitution: Max $\frac{7}{8}$

Wrong K_c expression: Max $\frac{5}{8}$

OPTION 2	NO	O ₂	NO ₂	
Initial quantity (mol)	4	2,5	2,6	✓
Change (mol)	0,75	0,375	0,75	✓
Quantity at equilibrium (mol)	3,25	2,125	3,35	✓
Equilibrium concentration (mol.dm ⁻³)	6,5	4,25	6,7	✓

$$K_c = \frac{[NO_2]^2}{[NO]^2[O_2]} \checkmark$$

$$\therefore 0,25 \checkmark = \frac{[NO_2]^2}{(6,5)^2(4,25)} \checkmark$$

$$[NO_2] = 6,7 \text{ mol} \cdot \text{dm}^{-3}$$

No K_c expression, correct substitution: Max $\frac{7}{8}$

Wrong K_c expression: Max $\frac{5}{8}$

(8)
[15]

QUESTION 7.

- 7.1.1 H_2SO_4 ✓ (1)
- 7.1.2 H_2SO_4 donates a proton (to H_2O). ✓ (1)
- 7.1.3 HSO_4^- . ✓ (1)
- 7.1.4 H_2SO_4 ✓ (1)
- 7.2.1 (The point) where the indicator changes colour. ✓ (1)
- 7.2.2 Methyl orange✓ (1)
- 7.2.3 Reaction between strong acid and weak base. ✓
pH will be less than 7 at endpoint, ✓ which corresponds to pH range when
indicator changes colour. (2)

7.3

Marking criteria:

- Substitute 1,2 and 0,175 in $n = cV$ to calculate $n(\text{HNO}_3)_{\text{initial}}$ ✓
- Ratio $\text{HNO}_3 : \text{Na}_2\text{CO}_3 = 2:1$ ✓
- Substitute 0,65 and 0,01294 $n(\text{HNO}_3)_{\text{initial}}$ to calculate $n(\text{HNO}_3)_{\text{excess}}$ in 25 cm^3 ✓
- Calculate $n(\text{HNO}_3)_{\text{excess}}$ in 175 cm^3 ✓
- $n(\text{HNO}_3)_{\text{initial}} - n(\text{HNO}_3)_{\text{excess}} = n(\text{HNO}_3)_{\text{reacted}}$ ✓✓ (for subtraction)
- Ratio $\text{HNO}_3 : \text{KOH} = 1:1$ to calculate $n(\text{KOH})_{\text{pure}}$ ✓
- Substitute molar mass of KOH (56 g) to calculate mass of $(\text{KOH})_{\text{pure}}$ ✓
- Substitute pure and impure mass in percentage purity formula ✓
- Final answer: 64,57 % ✓ Range (63 – 64,57%)

$$\begin{aligned}n(\text{HNO}_3)_{\text{initial}} &= cV \\&= (1,2) \frac{(175)}{(1000)} \quad \checkmark \\&= 0,21 \text{ mol} \\n(\text{HNO}_3)_{\text{excess in } 25 \text{ cm}^3} &= 2n(\text{Na}_2\text{CO}_3) \quad \checkmark \\&= 2cV \\&= 2(0,65) \frac{(12,94)}{(1000)} \quad \checkmark \\&= 0,016822 \text{ mol} \\n(\text{HNO}_3)_{\text{excess in } 175 \text{ cm}^3} &= (0,016822)(7) \quad \checkmark \\&= 0,117754 \text{ mol} \\n(\text{HNO}_3)_{\text{reacted with KOH}} &= 0,21 - 0,117754 \quad \text{(for subtraction)} \quad \checkmark \checkmark \\&= 0,092246 \text{ mol} \\n(\text{KOH})_{\text{pure}} &= n(\text{HNO}_3)_{\text{reacted}} \quad \checkmark \\&= 0,092246 \text{ mol}\end{aligned}$$

$$\begin{aligned}n(\text{KOH})_{\text{pure}} &= \frac{m}{M} \\0,092246 &= \frac{m}{56} \quad \checkmark \\m(\text{KOH})_{\text{pure}} &= 5,165776 \text{ g} \\\% \text{ purity} &= \frac{5,165776}{8} \times 100 \quad \checkmark \\&= 64,57 \% \quad \checkmark \\&\text{Range (63 – 64,57\%)}\end{aligned}$$

TOTAL: (10)
[18]
100