



**GERT SIBANDE DISTRICT
MKHONDO EAST, WEST & AMSTERDAM
CIRCUITS**

GRADE 12

**PHYSICAL SCIENCES TOPIC TEST
FEBRUARY 2022
TOPIC: ORGANIC MOLECULES
QUESTION PAPER**

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MARKS: 50

TIME: 1:00 HOUR

This question paper consists of 5 pages

INSTRUCTIONS AND INFORMATION

1. Answer ALL questions.
2. Number all your answers correctly.
3. Write neatly and legibly.

QUESTION 1

1.1 Which of the following is an saturated hydrocarbon compound?

- A $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$
- B $\text{CH}_3\text{C}=\text{CCH}_3$
- C $\text{CH}_3\text{CH}=\text{CHCH}_3$
- D $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$

(2)

1.2 Which of the following compounds is a functional isomer of propanone?

- A Propane
- B propene
- C Prop-1-ol
- D propanal

(2)
[4]

QUESTION 2

2.1 Define the term homologous series.

(2)

2.2 The table below shows some of the homologous series, structural formula of the functional groups and names of the functional groups of organic molecules. Complete the table by writing the answer next to the question numbers **2.2 (a)** to **2.2 (i)** in your answer sheet.

Homologous series	Structural formula of the functional group	Name of the functional group
Aldehyde	2.2 (a)	2.2 (b)
2.2 (c)	$\begin{array}{c} \text{O} \\ \\ -\text{C}-\text{O}-\text{C}- \\ \end{array}$	
Haloalkane (alkyl halide)	2.2 (d)	

Carboxylic acid	2.2 (e)	2.2 (f)
2.2 (g)	2.2 (h)	carbonyl
Alcohol	2.2 (i)	hydroxyl

(9)
[11]

QUESTION 3

organic compounds **A** and **B** and **C** are shown below.

A. pent-2-yne **B.** C₄H₁₀ **C.** C₄H₈

3.1 For compound **A**, write down its;

3.1.1 Structural formula. (1)

3.1.2 The general formula of the homologous series where it belongs. (1)

3.2 Compound **A** under goes combustion reaction.

Use the molecular formula to Write down a balanced chemical equation for the complete combustion of compound **A**. (3)

3.3 Compound **A** under goes cracking reaction according to the chemical reaction below.



Write down the condensed structural formula of compound **X**. (1)

3.4 Both compounds **B** and **C** exhibit isomerism.

3.4.1 State the difference between chain isomers and position isomers. (2)

3.4.2 Write down the structural formulae of the TWO chain isomers of compound **B**. (2)

3.4.3 Write down the structural formulae of the TWO position isomers of compound **C**. (2)

[12]

QUESTION 4

The table below shows the molecular formulae and vapour pressures of organic compounds at 25°C.

Compound	Molecular formula	Vapour pressure at 25 °C
CH ₃ CH ₂ CH ₃ Propane	C ₃ H ₈	843
CH ₃ CH ₂ CH ₂ CH ₃ Butane	C ₄ H ₁₀	204
CH ₃ CH(CH ₃)CH ₃ 2-methyl propane	C ₄ H ₁₀	380

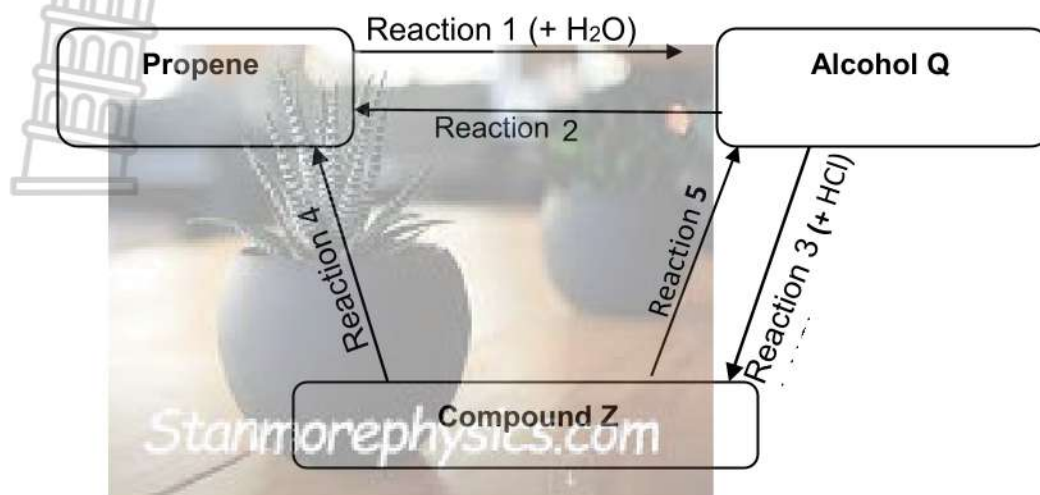
- 4.1 Define the term boiling point. (1)
- 4.2 State which one of the compounds Propane or butane has a lower boiling point? Explain the answer. (4)
- 4.3 Explain why the vapour pressure of 2-methylpropane is higher than that of butane (3)
- 4.4 The homologous series and boiling points of compounds **X** and **Y** are shown in the table below.

Compound	Homologous series	Relative molecular mass	Boiling point (°C)
X . CH ₃ CH ₂ CH ₂ OH	Alcohol	67	97
Y . CH ₃ CH ₂ COOH	Carboxylic acid	74	120

- 4.4.1 What is the state of compound **X** at room temperature? (1)
- 4.4.2 Both compounds **X** and **Y** have similar relative molecular mass but different boiling points. Explain the difference in their boiling points. (3)
- [12]**

QUESTION 5

The flow diagram below shows a series of organic reactions leading to formation of various products.



- 5.1 In reaction 1, Propene reacts with water in presence of H_2SO_4 catalyst to form alcohol **Q**. Write down:
- 5.1.1 The name of reaction 1. (1)
- 5.1.2 Using structural formula, the balanced chemical equation for reaction. (3)
- 5.1.3 The IUPAC name of alcohol **Q**. (1)
- 5.2 State whether **Q** is a primary, secondary or tertiary alcohol. (1)
- 5.3 Reaction 2 is an elimination reaction.
Write down the type of this elimination reaction. (1)
- 5.4 In reaction 3, alcohol **Q** reacts with HCl to form a compound **Z**.
Write down:
- 5.4.1 The name of reaction 3. (1)
- 5.4.2 The structural formula of the functional group of compound **Z**. (1)
- 5.5 Both reactions 4 and 5 take place in the presence of the strong base.
Apart from heat, write down one other reaction condition;
- 5.5.1 For reaction 4. (1)
- 5.5.2 For reaction 5. (1)
- [11]
- TOTAL : 50**



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MEMORANDUM**

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This memorandum consists of 4 pages

QUESTION 1

1.1 C ✓✓

(2)

1.2 D ✓✓

(2)

[4]

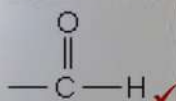
QUESTION 2

2.1 A series of organic compounds that can be described by the same general formula OR in which one member differs from the next with a CH₂ group. ✓✓

(2)

[2 or 0 mk]

2.2 (a)



(1)

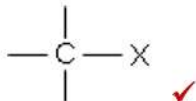
2.2 (b) Formyl ✓

(1)

2.2 (c) Esters ✓

(1)

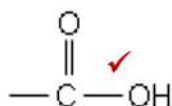
2.2 (d)



(X = F, Cl, Br, I)

(1)

2.2 (e)



(1)

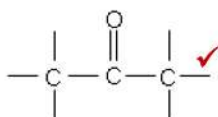
2.2 (f) Carboxyl ✓

(1)

2.2 (g) Ketone ✓

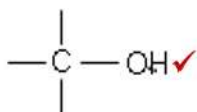
(1)

2.2 (h)



(1)

2.2 (i)

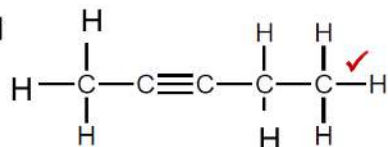


(1)

[11]

QUESTION 3

3.1.1



(1)

3.1.2 C_nH_{2n-2} ✓

(1)

3.2



[Reactants ✓ products ✓ balanced ✓]

(3)

3.3 CH_2CH_2 ✓

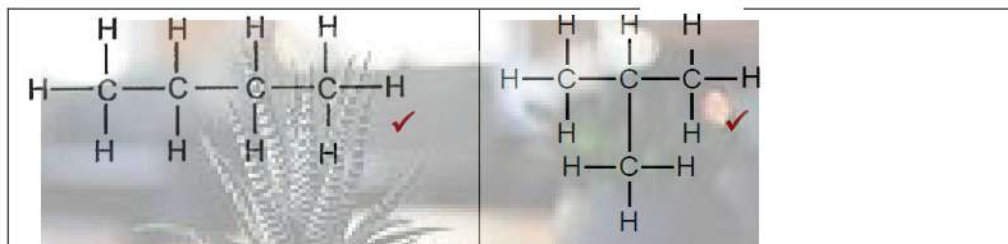
(1)

3.4.1 **Chain isomers**; organic compounds with the same molecular formula but different types of chains ✓

Position isomers; organic compounds with the same molecular formula but different position of the side chains, functional groups or substituents on the parent chain. ✓

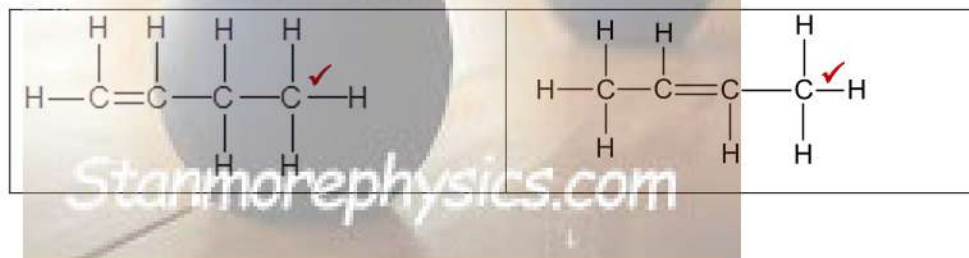
(2)

3.4.2



(2)

3.4.3



(2)
[12]

QUESTION 4

4.1 Temperature at which the vapour pressure of a substance equals atmospheric pressure. ✓

(1)

4.2 Propane ✓

-Increase in carbon chain increases the molecular mass and the contact area/surface area (over which intermolecular forces/London forces work (in butane). ✓

-This increases the strength of intermolecular forces/London forces (in butane). ✓

- More energy is required to overcome the intermolecular forces/London forces (in butane). ✓

OR:

-Decrease in carbon chain decreases the molecular mass and the contact area/surface area (over which intermolecular forces/London forces work (in propane). ✓

-This decreases the strength of intermolecular forces/London forces (in propane). ✓

- Less energy is required to overcome the intermolecular forces/London forces (in propane). ✓

(4)

- 4.3 -Branching (in 2-methylpropane) makes the molecule more spherical/compact with less surface area (over which intermolecular forces/London forces work). ✓
 - This decreases the strength of intermolecular forces/London forces (in 2-methylpropane). ✓
 - Less energy is required to overcome the intermolecular forces/London forces (in 2-methylpropane). ✓ (3)

4.4.1 Gas ✓ (1)

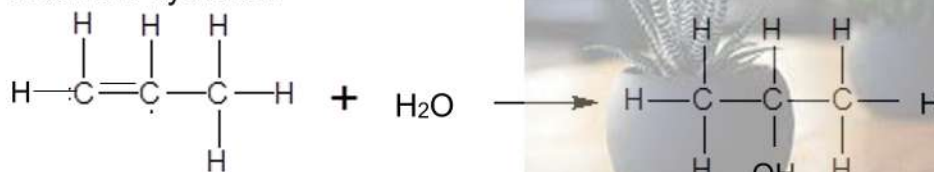
- 4.4.2 -In molecules of both X / alcohol and Y/ carboxylic acid there are hydrogen bonds. ✓
 - X / alcohol has one site of hydrogen bond formation but Y/ carboxylic acid has two sites of hydrogen bond formation.
 - Hydrogen bonds in Y/ carboxylic acid are stronger than those in X / alcohol ✓
 -More energy is required to overcome hydrogen bonds in Y/ carboxylic acid. ✓ (3)

[12]

QUESTION 5

5.1.1 Addition/ hydration (1)

5.1.2



[Reactants ✓ products ✓ balanced ✓] Stanmorephysics.com (3)

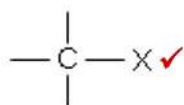
5.1.3 Propan-2-ol ✓ OR: 2-propanol (1)

5.2 Secondary ✓ (1)

5.3 Dehydration ✓ (1)

5.4.1 Substitution ✓ (1)

5.4.2



(X = F, Cl, Br, I) (1)

5.5.1 Concentrated strong base ✓ (1)

5.5.2 Dilute strong base ✓ (1)

[11]

TOTAL: 50