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REPUBLIC OF SOUTH AFRICA

PROVINCIAL ASSESSMENT

GRADE 12

TECHNICAL SCIENCES P2

JUNE 2025

MARKS: 75

TIME: 1½ hours

This question paper consists of 10 pages and 2 data sheets.



INSTRUCTIONS AND INFORMATION

1. This question paper consists of FIVE questions. Answer ALL the questions in the ANSWER BOOK.
2. Start EACH question on a NEW page in the ANSWER BOOK.
3. Number the answers correctly according to the numbering system used in this question paper.
4. Leave ONE line between two subquestions, e.g. between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable calculator.
6. You are advised to use the attached DATA SHEETS.
7. Round off your FINAL numerical answers to a minimum of TWO decimal places.
8. Give brief motivations, discussions, etc. where required.
9. Write neatly and legibly.



QUESTION 1: MULTIPLE-CHOICE QUESTIONS

Various options are provided as possible answers to the following questions. Choose the answer and write only the letter (A–D) next to the question number (1.1 to 1.5) in the ANSWER BOOK, e.g. 1.6 D.

1.1 Butane is an example of the organic group ...

- A alkene.
- B esters.
- C alkanes.
- D ketones.

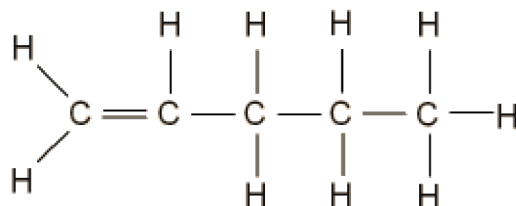
(2)

1.2 Which ONE of the following is the CORRECT homologous series with the name of the functional group?

	HOMOLOGOUS SERIES	NAME OF FUNCTIONAL GROUP
A	Alcohol	Hydroxyl group
B	Ketone	Carboxyl group
C	Carboxylic acid	Formyl group
D	Aldehyde	Carboxyl group

(2)

1.3 Consider the structural formula of the compound below. Identify the CORRECT IUPAC name and the type of hydrocarbon:

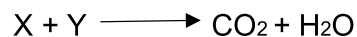


	IUPAC NAME	TYPE OF HYDROCARBON
A	Pent-2-ene	Saturated
B	2-Pentane	Unsaturated
C	Pent-2-ene	Unsaturated
D	Pent-3-ene	Saturated

(2)



1.4 Consider the organic reaction below.



What is represented by **X** and **Y**?

- A Haloalkane and oxygen
- B Hydrocarbon and oxygen
- C Oxygen and esters
- D Hydrocarbon and haloalkane

(2)

1.5 Which of the following are examples of intrinsic and extrinsic semiconductor?

	INTRINSIC SEMICONDUCTOR	EXTRINSIC SEMICONDUCTOR
A	Silicon	Arsenic
B	Phosphorous	Arsenic
C	Silicon	Germanium
D	Phosphorous	Germanium

(2)
[10]



QUESTION 2 (Start on a new page.)

Consider the following organic molecules represented by letters **A** to **F**.

A	$ \begin{array}{cccc} & \text{H} & \text{H} & \text{H} & \text{H} \\ & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{C} & - \text{C} & - \text{H} \\ & & & & \\ & \text{H} & \text{H} & \text{H} & \text{H} \end{array} $	B	Pent-3-ene
C	$\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$	D	2-methylpropan-2-ol
E	$ \begin{array}{ccccc} & \text{H} & & \text{O} & & \text{H} \\ & & & & & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - \text{H} \\ & & & & & \\ & \text{H} & & & & \text{H} \end{array} $	F	$ \begin{array}{ccccccc} & \text{H} & & \text{H} & & & \\ & & & & & & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{C} & \\ & & & & & // & \text{O} \\ & \text{H} & & \text{H} & & & \\ & & & & & \backslash & \text{O} & - & \text{C} & - & \text{C} & - \text{H} \\ & & & & & & & & & & \\ & & & & & & & & \text{H} & & \text{H} \\ & & & & & & & & & & \\ & & & & & & & & & & \text{H} & & \text{H} \end{array} $

2.1 Define the following terms:

2.1.1 *Hydrocarbon* (2)

2.1.2 *Functional group* (2)

2.2 Write down the letter (s) that represent (s) the following:

2.2.1 Hydrocarbon (2)

2.2.2 An ester (1)

2.2.3 A carbonyl group (1)

2.2.4 Chain isomers (2)

2.3 Give the IUPAC name of the following compounds:

2.3.1 **C** (2)

2.3.2 **E** (2)

2.3.3 **F** (2)



2.4 Write down the GENERAL FORMULA for the following compounds:

2.4.1 **E** (1)

2.4.2 **F** (1)

2.5 Give the STRUCTURAL FORMULA of:

2.5.1 **B** (2)

2.5.2 the positional isomer of **C** (2)

2.6 Define the term *polymer*. (2)

2.7 Write down the NAME of the polymer that is formed by the monomers of compound **B**. (1)
[25]



QUESTION 3 (Start on a new page.)

Three compounds are used to investigate ONE of the factors that influences boiling point. The table below shows the results obtained.

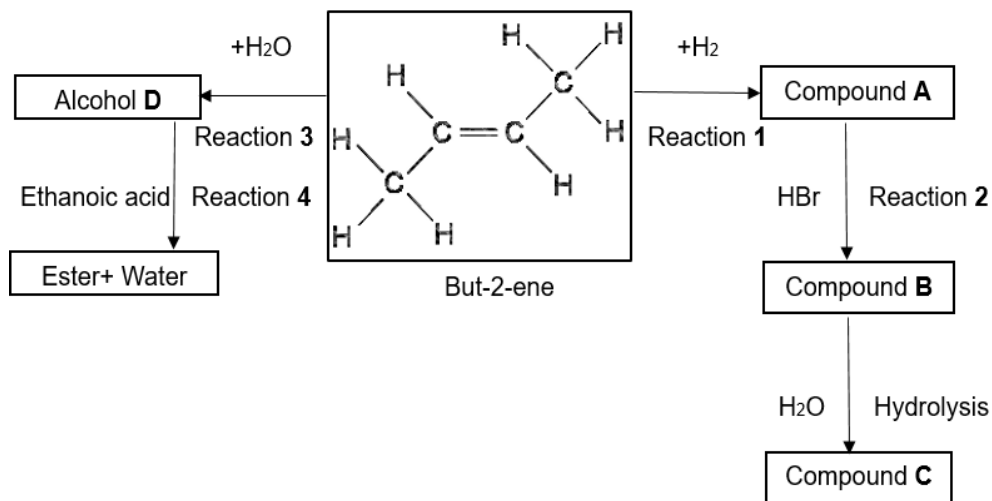
	COMPOUND	MOLECULAR MASS	BOILING POINT (°C)
A	Propane	56	-0,5
B	Butan-1-ol	58	98
C	Ethanoic acid	58	116

- 3.1 Define the term *vapour pressure*. (2)
- 3.2 Is compound **B** a PRIMARY, SECONDARY or TERTIARY alcohol? (2)
Explain the answer.
- 3.3 Write the TYPE OF INTERMOLECULAR FORCE present in the following compounds:
- 3.3.1 **A** (1)
- 3.3.2 **B** (1)
- 3.4 Which ONE of compounds **A**, **B** or **C** will be a gas at room temperature? (1)
- 3.5 Give the NAME of the compound with the LOWEST vapour pressure. (1)
- 3.6 Explain the answer to QUESTION 3.5 by referring to the INTERMOLECULAR FORCES. (2)
- 3.7 Define the term *chain isomer*. (2)
- 3.8 Give the STRUCTURAL formula of the chain isomer of compound **B**. (2)

[14]

QUESTION 4 (Start on a new page.)

The flow diagram below illustrates different organic reactions using But-2-ene as the starting reactants. Study the flow diagram and then answer the questions that follow.



- 4.1 Write the TYPE of addition reaction represented by:
- 4.1.1 Reaction 2 (1)
 - 4.1.2 Reaction 3 (1)
- 4.2 What type of reaction is hydrolysis? (1)
- 4.3 Give the IUPAC name of the following compounds:
- 4.3.1 A (1)
 - 4.3.2 B (1)
 - 4.3.3 Secondary alcohol D (1)
- 4.4 Write down the reaction conditions of the following reactions:
- 4.4.1 Reaction 1 (1)
 - 4.4.2 Reaction 2 (1)
- 4.5 Give the STRUCTURAL formula of compound C. (2)
- 4.6 Use STRUCTURAL FORMULAE to write down a balanced chemical equation for Reaction 1. (3)



4.7 Prop-2-ene (C_3H_6) reacts with excess oxygen. Write the:

4.7.1 Type of reaction taking place (1)

4.7.2 Balanced chemical equation for this reaction (3)

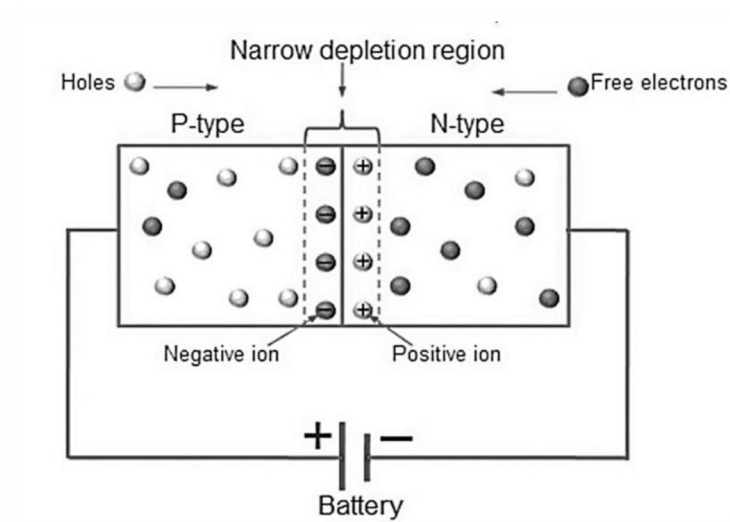
4.8 Name ONE application in the technical industry where this type of reaction in QUESTION 4.7 can be found.

(1)
[18]



QUESTION 5 (Start on a new page.)

Doping is the process of adding impurities to intrinsic semiconductors. Study the diagram below and answer the questions that follow.



5.1 Define the following terms:

5.1.1 *Semiconductor* (2)

5.1.2 *Intrinsic semiconductor* (2)

5.2 Explain the connection of a FORWARD biased p-n junction diode. (2)

5.3 Give TWO examples of semiconductors. (2)

[8]

TOTAL: 75



DATA FOR TECHNICAL SCIENCES GRADE 12**PAPER 2****GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 12****VRAESTEL 2****TABLE 1/TABEL 1: PHYSICAL CONSTANTS/FISIESE KONSTANTES**

NAME/NAAM	SYMBOL/SIMBOOL	VALUE/WAARDE
Standard pressure <i>Standaarddruk</i>	$p^\ominus$	$1,01 \times 10^5 \text{ Pa}$
Standard temperature <i>Standaardtemperatuur</i>	$T^\ominus$	273 K/0 °C

TABLE 2/TABEL 2: FORMULAE/FORMULES

Emf/Emk	$E_{\text{cell}}^\ominus = E_{\text{cathode}}^\ominus - E_{\text{anode}}^\ominus \quad / \quad E_{\text{sel}}^\ominus = E_{\text{atode}}^\ominus - E_{\text{anode}}^\ominus$ or/of $E_{\text{cell}}^\ominus = E_{\text{reduction}}^\ominus - E_{\text{oxidation}}^\ominus \quad / \quad E_{\text{sel}}^\ominus = E_{\text{reduksie}}^\ominus - E_{\text{oksidasie}}^\ominus$ or/of $E_{\text{cell}}^\ominus = E_{\text{oxidising agent}}^\ominus - E_{\text{reducing agent}}^\ominus \quad /$ $E_{\text{sel}}^\ominus = E_{\text{oksideermiddel}}^\ominus - E_{\text{reduseermiddel}}^\ominus$
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KEY																			
1 (I)	2 (II)	3	4	5	6	7	8	9	10	11	12	13 (III)	14 (IV)	15 (V)	16 (VI)	17 (VII)	18 (VIII)		
1 H 1,01	2 He 4											3 Li 6,94	4 Be 9	5 B 10,81	6 C 12	7 N 14	8 O 16	9 F 19	10 Ne 20
11 Na 23	12 Mg 24											13 Al 27	14 Si 28	15 P 31	16 S 32	17 Cl 35,5	18 Ar 40		
19 K 39	20 Ca 40											31 Ga 70	32 Ge 73	33 As 75	34 Se 79	35 Br 80	36 Kr 84		
37 Rb 86	38 Sr 88											49 In 115	50 Sn 119	51 Sb 122	52 Te 128	53 I 127	54 Xe 131		
55 Cs 133	56 Ba 137											81 Tl 204	82 Pb 207	83 Bi 209	84 Po	85 At	86 Rn		
87 Fr	88 Ra 226																		

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