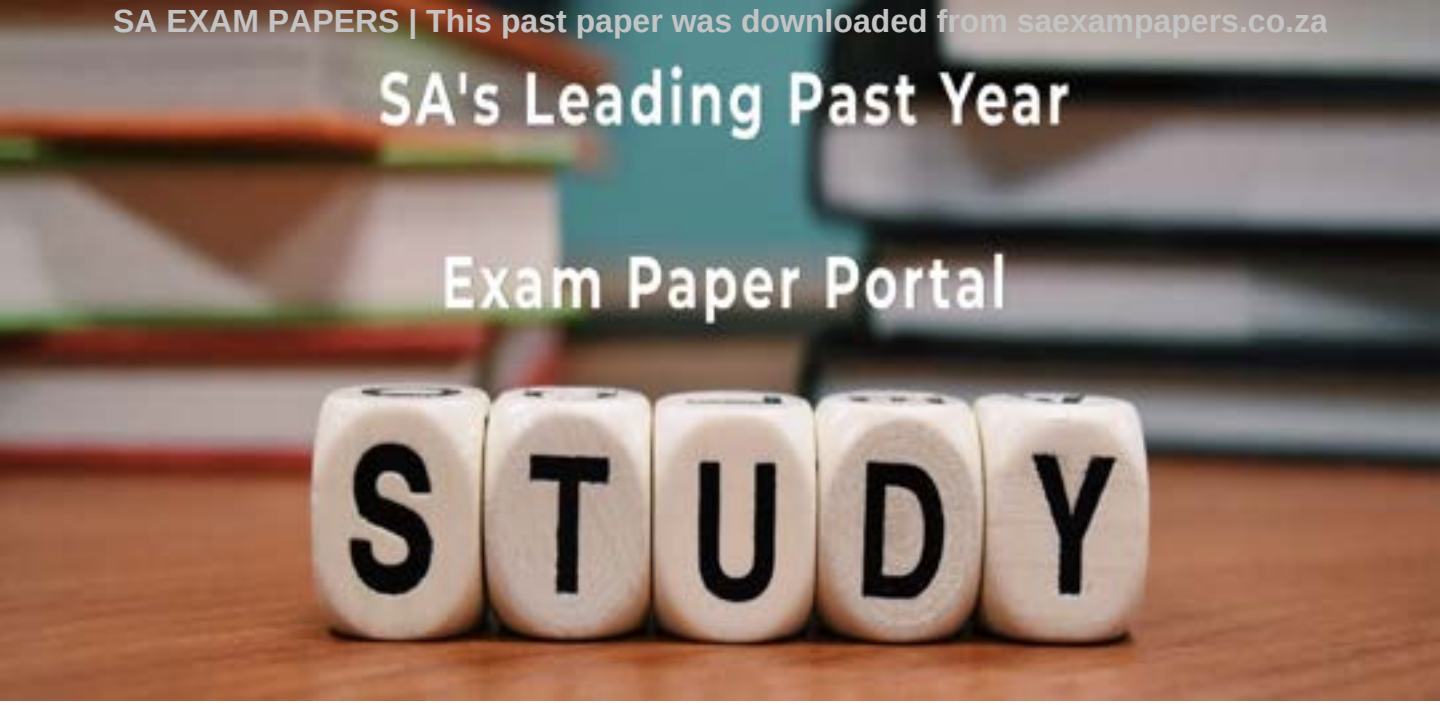

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NATIONAL SENIOR CERTIFICATE

GRADE 12

JUNE 2025

TECHNICAL SCIENCES P2

MARKS: **75**

TIME: **1½ hours**

* J T S C E 2 *

This question paper consists of 10 pages, including 1 data sheet.

INSTRUCTIONS AND INFORMATION

1. Write your FULL NAME and SURNAME in the appropriate spaces in the ANSWER BOOK.
2. This question paper consists of FIVE questions. Answer ALL the questions.
3. Start EACH question on a NEW page in the ANSWER BOOK.
4. Number the answers correctly according to the numbering system used in this question paper.
5. Leave ONE line between two subquestions, for example between QUESTION 2.1 and QUESTION 2.2.
6. You may use a non-programmable calculator.
7. You are advised to use the attached DATA SHEET.
8. Round off your FINAL numerical answers to a minimum of TWO decimal places.
9. You may use appropriate mathematical instruments.
10. Show ALL formulae and substitutions in ALL calculations.
11. Give brief motivations, discussions et cetera where required.
12. 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 numbers (1.1 to 1.5) in the ANSWER BOOK, for example 1.6 D.

1.1 Which of the following compounds represent a positional isomer of 1-chloropropane?

A 1,2-dichloropropane

B 2-chloropropane

C 1-bromopropane

D propan-2-ol (2)

1.2 Butane is burned in excess oxygen. What is the CORRECT balanced equation for the combustion of butane?

A $C_4H_{10} + 2O_2 \rightarrow 4CO_2 + 5H_2O$

B $C_4H_{10} + 6{,}5O_2 \rightarrow 4CO_2 + 5H_2O$

C $2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

D $4C_4H_{10} + 26O_2 \rightarrow 16CO_2 + 20H_2O$ (2)

1.3 The TYPE of intermolecular forces found in carboxylic acids.

A London forces and hydrogen bonds

B London forces and dipole-dipole forces

C London forces and ion-dipole forces

D Only London forces (2)

1.4 The TYPE of substitution reaction where a haloalkane is converted to an alcohol is known as …

A hydrohalogenation.

B hydrogenation.

C hydrolysis of haloalkanes.

D hydration. (2)

1.5 How many electrons does a pentavalent material have in its outermost energy level?

A 2

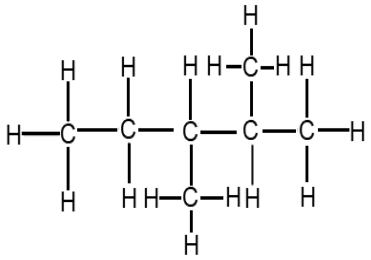
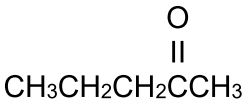
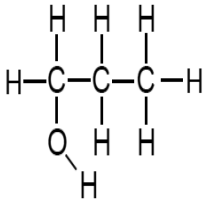
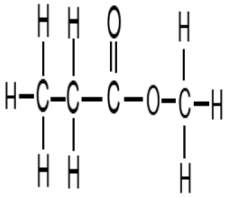
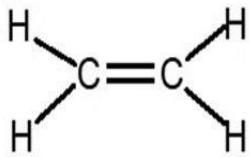
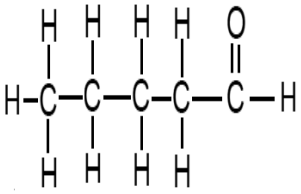
B 3

C 4

D 5 (2)
[10]

QUESTION 2 (Start on a new page.)

Consider the organic compounds represented by the letters **A** to **H** below and answer the questions that follow.

A		**B**	C_4H_9Br
C		**D**	
E	3,4-dimethylhex-1-yne	**F**	
G		**H**	

2.1 Define the term *homologous series.* (2)

2.2 Write the name of the HOMOLOGOUS SERIES to which each of the following compounds belong:

2.2.1 **B** (1)

2.2.2 **D** (1)

2.3 Write down the letter(s) that represents the following compounds:

2.3.1 An alkene (1)

2.3.2 A ketone (1)

2.3.3 Having the general formula C_nH_{2n-2} (1)

2.3.4 A saturated hydrocarbon (1)

2.3.5 That has the same general formula as a carboxylic acid (1)

2.4 Compounds **C** and **H** are structural isomers.

2.4.1 Define the term *structural isomer*. (2)

2.4.2 What TYPE of structural isomers are compounds **C** and **H**? (1)

2.5 Is compound **D** a PRIMARY, SECONDARY or TERTIARY alcohol?

Give a reason for the answer. (3)

2.6 Consider compound **C**, **E**, **F** and **H**.

2.6.1 Write down the IUPAC name of compound **F** (2)

2.6.2 Draw the structural formula of compound **E** (3)

2.6.3 Write down the name of the functional group of compound **C** (1)

2.6.4 Draw the structural formula for the functional group of compound **H** (1)

2.7 Compound **G** is a monomer.

2.7.1 Define the term *polymerisation*. (2)

2.7.2 Write down the name of a polymer that can be formed from monomer **G**. (2)

[26]

QUESTION 3 (Start on a new page.)

A group of grade 12 learners were observing the boiling points of five organic compounds from three different homologous series. The number of carbon atoms of these organic compounds ranges between 3 carbon atoms and 4 carbon atoms. Their results were tabulated as follows.

Compound	Name	Boiling point	Molecular Formula
A	Propane	−42 °C	C_3H_8
B	Butane	−1 °C	C_4H_{10}
C	1-Bromopropane	64,7 °C	C_3H_7Br
D	1-Bromobutane	101,4 °C	C_4H_9Br
E	Butan-1-ol	117,7 °C	C_4H_9OH

3.1 Define the term *boiling point.* (2)

3.2 Which type of intermolecular forces occur in each of the following compounds?

3.2.1 **D** (1)

3.2.2 **E** (1)

3.3 Explain how the boiling points of compounds **A** and **B** compare to each other by referring to the INTERMOLECULAR FORCES, STRUCTURE, STRENGTH and THE ENERGY NEEDED. (4)

3.4 Define the term *vapour pressure*. (2)

3.5 Which compound from the table above, will have the highest vapour pressure?

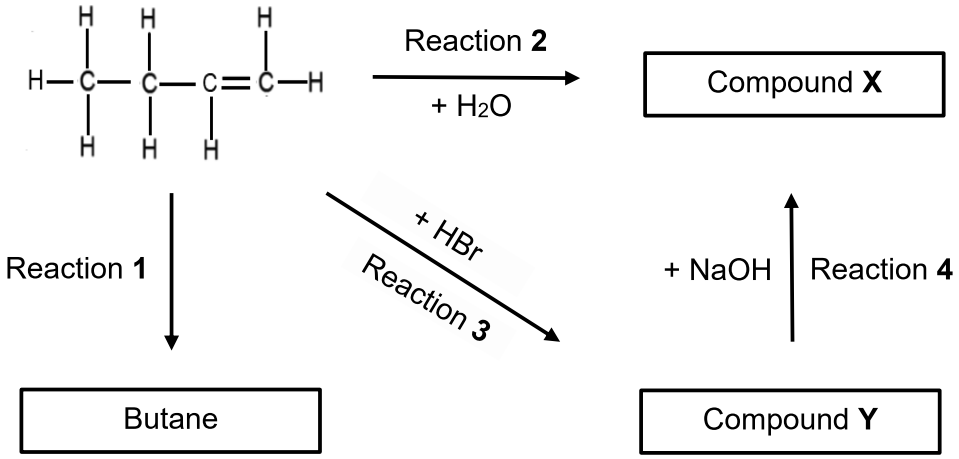
Give a reason for the answer. (2)

3.6 Which compound from the table above, will have the highest viscosity? (1)

[13]

QUESTION 4 (Start on a new page.)

But-1-ene undergoes various reactions, and different products are formed from each reaction. Study the diagram below and answer the questions that follow.



4.1 Write down the type of reaction represented by the following reactions:

4.1.1 Reaction **1** (1)

4.1.2 Reaction **3** (1)

4.1.3 Reaction **4** (1)

4.2 For Reaction **1**, write down:

4.2.1 The MOLECULAR formula of the inorganic reagent used (1)

4.2.2 ONE catalyst needed for this reaction to take place (1)

4.3 Compound **Y** is formed as a product in reaction **3**. Write down the:

4.3.1 STRUCTURAL formula of compound **Y** (2)

4.3.2 IUPAC name of compound **Y** (2)

4.4 Compound **X** is formed when but-1-ene reacts with H_2O in reaction **2**.

4.4.1 Name the TYPE of addition reaction that takes place. (2)

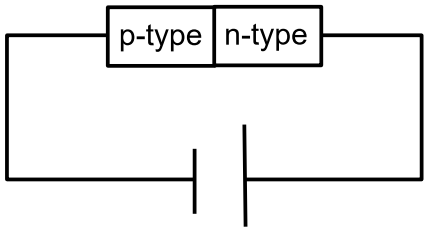
4.4.2 Write down the IUPAC name of compound **X**. (2)

4.4.3 Write down TWO reaction conditions needed for reaction **2** to take place. (2)

[15]

QUESTION 5 (Start on a new page.)

Semiconductors are used in the manufacture of electronic devices such as diodes, transistors, and integrated circuits. Consider the diagram below and answer the questions that follow.



5.1 Define the term *intrinsic semiconductor.* (2)

5.2 Give ONE example of intrinsic semiconductors. (1)

5.3 Is the diagram of the diode above FORWARD BIAS or REVERSE BIAS?

Give a reason for the answer. (3)

5.4 Define the term *doping.* (2)

5.5 Explain why doping is done in a semiconductor. (2)

5.6 Which type of semiconductor forms when boron is added to silicon? (1)

[11]

TOTAL: 75

TABLE 3: THE PERIODIC TABLE OF ELEMENTS/*TABEL 3: DIE PERIODIEKE TABEL VAN ELEMENTE*

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)
2,1 1 H 1																	2 He 4
1,0 3 Li 7	1,5 4 Be 9											2.0 5 B 11	2.5 6 C 12	3.0 7 N 14	3.5 8 O 16	4.0 9 F 19	10 Ne 20
0,9 11 Na 23	1,2 12 Mg 24											1.5 13 Aℓ 27	1.8 14 Si 28	2.1 15 P 31	2.5 16 S 32	3.0 17 Cℓ 35,5	18 Ar 40
0,8 19 K 39	1,0 20 Ca 40	1,3 21 Sc 45	1,5 22 Ti 48	1.6 23 V 51	1.6 24 Cr 52	1.5 25 Mn 55	1.8 26 Fe 56	1.8 27 Co 59	1.8 28 Ni 59	1.9 29 Cu 63,5	1.6 30 Zn 65	1.6 31 Ga 70	1.8 32 Ge 73	2.0 33 As 75	2.4 34 Se 79	2.8 35 Br 80	36 Kr 84
0,8 37 Rb 86	1,0 38 Sr 88	1,2 39 Y 89	1,4 40 Zr 91	41 Nb 92	1,8 42 Mo 96	1.9 43 Tc	2.2 44 Ru 101	2.2 45 Rh 103	2.2 46 Pd 106	1.9 47 Ag 108	1.7 48 Cd 112	1.7 49 In 115	1.8 50 Sn 119	1.9 51 Sb 122	2.1 52 Te 128	2.5 53 I 127	54 Xe 131
0,7 55 Cs 133	0,9 56 Ba 137	57 La 139	1,6 72 Hf 179	73 Ta 181	74 W 184	75 Re 186	76 Os 190	77 Ir 192	78 Pt 195	79 Au 197	80 Hg 201	1.8 81 Tℓ 204	1.8 82 Pb 207	1.9 83 Bi 209	2.0 84 Po	2.5 85 At	86 Rn
0,7 87 Fr	0,9 88 Ra 226	89 Ac															

58 Ce 140	59 Pr 141	60 Nd 144	61 Pm	62 Sm 150	63 Eu 152	64 Gd 157	65 Tb 159	66 Dy 163	67 Ho 165	68 Er 167	69 Tm 169	70 Yb 173	71 Lu 175
90 Th 232	91 Pa	92 U 238	93 Np	94 Pu	95 Am	96 Cm	97 Bk	98 Cf	99 Es	100 Fm	101 Md	102 No	103 Lr

KEY/ *SLEUTEL*

Atoomgetal
Atomic number

Elektronegatiwiteit
Electronegativity

29
Cu
1,9
63,5

Simbool
Symbol

Benaderde relatiewe atoommassa
Approximate relative atomic mass