GAUTENG PROVINCE
EDUCATION
REPUBLIC OF SOUTH AFRICA

JUNE EXAMINATION
GRADE 12

2026

TECHNICAL SCIENCES

(PAPER 2)

TECHNICAL SCIENCES P2

C2102E

TIME: 1½ hours

MARKS: 75

10 pages + 2 data sheets

X05

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 your ANSWER BOOK.
3. Number your answers correctly, according to the numbering system used in this question paper.
4. Leave ONE LINE open between subquestions, e.g. between QUESTION 2.1 and QUESTION 2.2.
5. You may use a non-programmable scientific calculator.
6. You are advised to use the attached DATA SHEETS.
7. Show ALL formulae and substitutions in ALL calculations.
8. Round-off your FINAL answers to a minimum of TWO decimal places.
9. Give brief motivations, discussions et cetera where required.
10. Write neatly and legibly.

QUESTION 1: MULTIPLE-CHOICE QUESTIONS

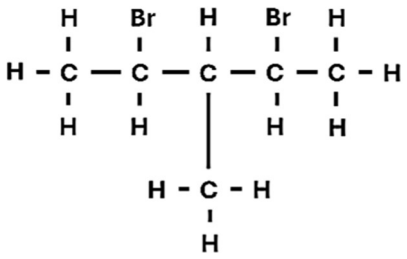
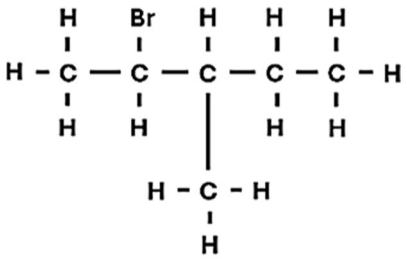
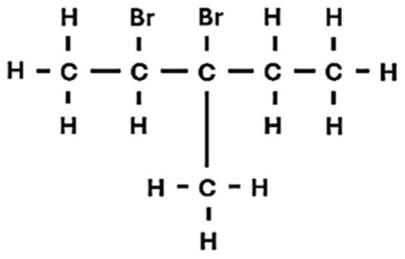
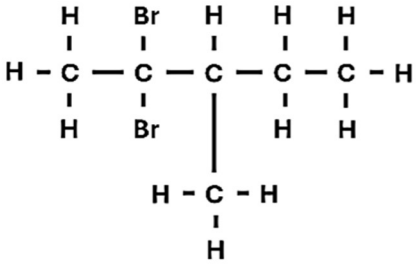
Various options are provided as possible answers to the following questions. Choose the correct answer and write only the letter (A – D) next to the question numbers (1.1 to 1.5) in the ANSWER BOOK, e.g. 1.6 D.

1.1 A homologous series can be described as:

A Organic molecules that only contain carbon atoms
B Organic compounds that can be described by the same general formula where each member differs from the next by a CH_2-group
C A formula that indicates which atoms are bonded to each other in the molecule
D A formula indicating the type and number of atoms in a molecule (2)

1.2 Identify which of the following structural formulae is correct for

2,2-dibromo-3-methyl pentane

A		B	
C		D	

(2)

1.3 The physical properties of butanoic acid were tested by Grade 12 Technical Sciences learners. Which of the following results obtained is correct?

	MELTING POINT	BOILING POINT	VAPOUR PRESSURE
A	High	High	High
B	Low	High	Low
C	Low	Low	High
D	High	High	Low

(2)

1.4 One of the conditions needed for hydrogenation to take place is a catalyst such as:

A H_2SO_4
B N
C Ni
D Co (2)

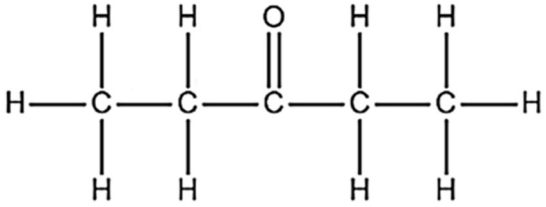
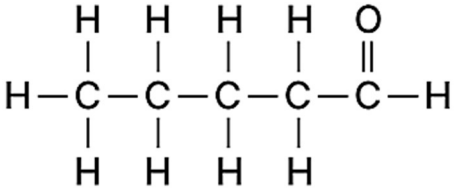
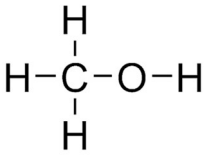
1.5 If Germanium is doped with a pentavalent atom, what type of semiconductor does it become?

A N-type semiconductor
B Intrinsic semiconductor
C P-N junction semiconductor
D P-type semiconductor (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	methyl propanoate	**B**	
C		**D**	C_4H_9Cl
E	CH_3CH_2COOH	**F**	C_4H_{10}
G	2-methylhex-3-yne	**H**	

2.1 Define the term *functional group*. (2)

2.2 Write down the letter(s) which represent(s) a/an:

2.2.1 Alkane (1)

2.2.2 Alcohol (1)

2.2.3 Unsaturated hydrocarbon (1)

2.2.4 Compound with a carboxyl functional group (1)

2.3 Consider compound **A**.

2.3.1 Identify the homologous series to which this compound belongs. (1)

2.3.2 Draw the STRUCTURAL FORMULA of this compound. (3)

2.3.3 Identify the TWO REACTANTS by writing the letters from the table above (**A** to **H**) which are used to form this compound. (2)

2.4 Consider compound **D**.

2.4.1 Identify the homologous series to which this compound belongs. (1)

2.4.2 Draw the STRUCTURAL FORMULA where the functional group is connected to a carbon atom, which is connected to two other carbons. (2)

2.4.3 What type of compound is formed when the functional group is connected as it is in QUESTION 2.4.2? Write only PRIMARY, SECONDARY or TERTIARY. (1)

2.4.4 Write the IUPAC name of the compound formed in QUESTION 2.4.2. (2)

2.5 Structural isomers are compounds with the same molecular formula but different structural formulae.

2.5.1 Identify two structural isomers from the table (**A** to **H**). (2)

2.5.2 Identify the specific type of structural isomers mentioned in QUESTION 2.5.1. (1)

2.5.3 Define the specific type of structural isomer identified in QUESTION 2.5.2. (2)

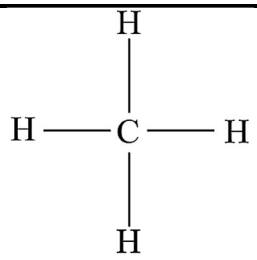
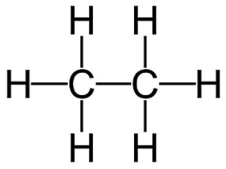
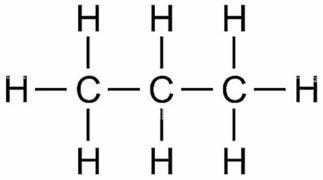
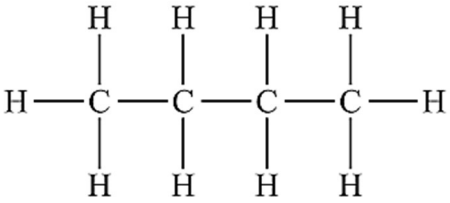
2.5.4 Write down the IUPAC name of both isomers identified in QUESTION 2.5.1. (4)

2.5.5 Draw the structural formulae of the FUNCTIONAL group of both structural isomers identified in QUESTION 2.5.1. (2)

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QUESTION 3 (Start on a new page.)

Saturated hydrocarbons are widely used as fuels and in various industrial applications, each having their own physical properties as indicated in the table below.

COMPOUND	STRUCTURAL FORMULA	INDUSTRIAL APPLICATION	VAPOUR PRESSURE ($\times 10^5$ Pa)
A		Heaters	52
B		Broken down to a monomer to form plastics	13
C		Stoves	8,5
D		Lighters	2,2

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

3.2 Identify the homologous series to which all the compounds, **A** to **D**, belong. (1)

3.3 Name the intermolecular force that is found in all the compounds, **A** to **D**. (1)

3.4 Explain why the vapour pressure decreases from compound **A** to **D**. Refer to the CHAIN LENGTH, STRENGTH OF THE INTERMOLECULAR FORCES and the ENERGY. (3)

3.5 Which compound will have the highest viscosity? (1)

3.6 Explain your answer to QUESTION 3.5. Refer to the STRENGTH OF THE INTERMOLECULAR FORCES and the RESISTANCE to flow. (2)

3.7 As stipulated in the table above, compound **B** can be broken down to form the monomer of polythene/polyethene, which is used in the production of plastics.

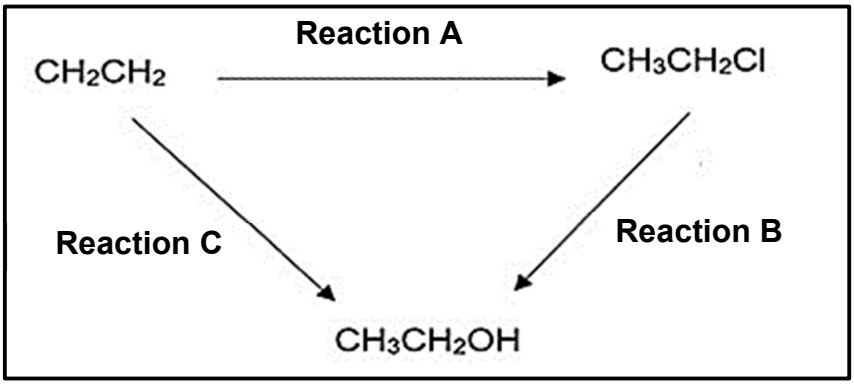
3.7.1 Define the term *monomer*. (2)

3.7.2 Name the PROCESS in which plastics are manufactured. (1)

3.7.3 Draw the STRUCTURAL FORMULA of the monomer of polythene. (2)
[15]

QUESTION 4 (Start on a new page.)

While doing some experiments, a learner found that there is more than one method to prepare a certain alcohol. Study the flow diagram below and use it to answer the following questions.



4.1 Write down the NAME of the substance added to CH_2CH_2 in reaction **A**. (1)

4.2 Name the TYPE of reaction taking place in:

4.2.1 Reaction **A** (1)

4.2.2 Reaction **B** (1)

4.2.3 Reaction **C** (1)

4.3 Use STRUCTURAL FORMULAE to write a balanced equation for reaction **C**. (3)

4.4 Write down the NAME or FORMULAE of the substance that needs to be added in excess so that CH_3CH_2OH can be formed. (1)

4.5 Write down the FORMULA of the base that can be added to the haloalkane for reaction **B** to take place. (1)

4.6 The learner also found that when a certain condition is met, CH_2CH_2 undergoes a complete oxidation reaction.

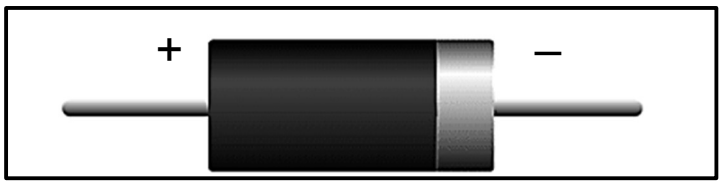
4.6.1 Write down the NAME of the substance needed for the complete oxidation of CH_2CH_2. (1)

4.6.2 Write down the FORMULA of the main products that will be formed when CH_2CH_2 undergoes complete oxidation. (2)

[12]

QUESTION 5 (Start on a new page.)

Semiconductors such as diodes and transistors, are widely used in modern electronics.



[Source: *www.electricaltechnology.org*]

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

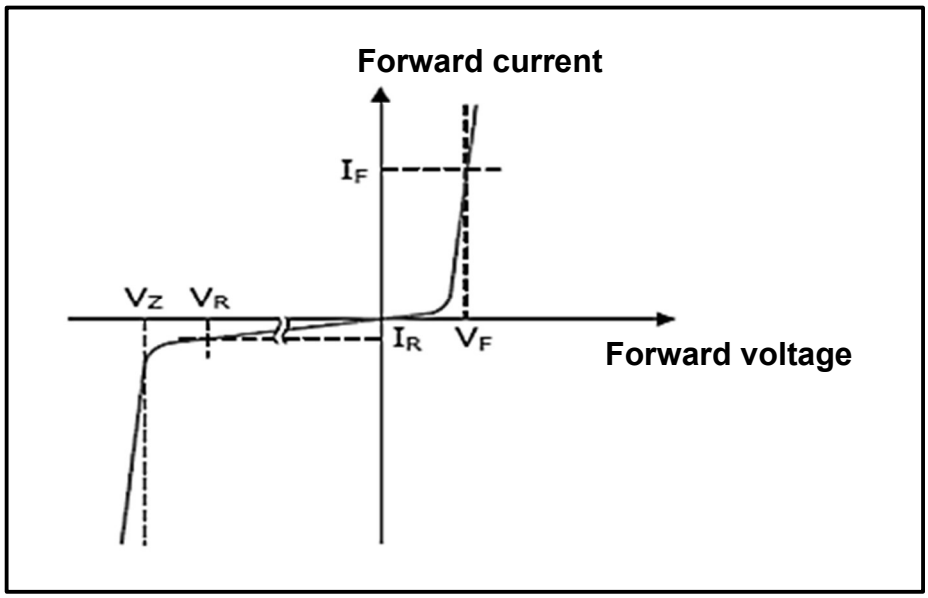
5.2 Name the process of adding impurities to intrinsic semiconductors for the improved conductivity of diodes. (1)

5.3 Write down the name of the lightly grey shaded side (the negative terminal) on the diode. (1)

5.4 How should the anode of the diode be connected to a cell/battery such that the diode is reversed biased? Write down only ANODE TO POSITIVE TERMINAL or ANODE TO NEGATIVE TERMINAL. (1)

5.5 What will happen to the depletion region if the positive terminal is connected to the n-type and the negative terminal is connected to the p-type in a p-n junction diode? (1)

5.6 Consider the diagram shown below.



5.6.1 Write down the NAME of the diagram represented above. (1)

5.6.2 Give labels for the voltages V_F and V_Z. (2)
[9]

TOTAL: 75

DATA FOR TECHNICAL SCIENCES GRADE 12 PAPER 2/*GEGEWENS VIR TEGNIESE WETENSKAPPE GRAAD 12 VRAESTEL 2*

TABLE 1: PHYSICAL CONSTANTS/*TABEL 1: FISIESE KONSTANTE*

NAME/*NAAM*	SYMBOL/*SIMBOOL*	VALUE/*WAARDE*
Standard pressure/ *Standaarddruk*	p^{θ}	1,01 x 10^5 Pa
Standard temperature/ *Standaardtemperatuur*	T^{θ}	0 °C/273 K

TABLE 2: FORMULAE/*TABEL 2: FORMULES*

ELECTROCHEMISTRY/*ELEKTROCHEMIE*	
Emf/*Emk*	$E^{\theta}_{cell} = E^{\theta}_{cathode} - E^{\theta}_{anode}$ / $E^{\theta}_{sel} = E^{\theta}_{katode} - E^{\theta}_{anode}$ or/*of* $E^{\theta}_{cell} = E^{\theta}_{reduction} - E^{\theta}_{oxidation}$ / $E^{\theta}_{sel} = E^{\theta}_{reduksie} - E^{\theta}_{oksidasie}$ or/*of* $E^{\theta}_{cell} = E^{\theta}_{oxidising\ agent} - E^{\theta}_{reducing\ agent}$ / $E^{\theta}_{sel} = E^{\theta}_{oksideermiddel} - E^{\theta}_{oksideermiddel}$

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 **H** 1																	**He** 4
1,0 **Li** 7	1,5 **Be** 9											2,0 **B** 11	2,5 **C** 12	3,0 **N** 14	3,5 **O** 16	4,0 **F** 19	**Ne** 20
0,9 **Na** 23	1,2 **Mg** 24											1,5 **Aℓ** 27	1,8 **Si** 28	2,1 **P** 31	2,5 **S** 32	3,0 **Cℓ** 35,5	**Ar** 40
0,8 **K** 39	1,0 **Ca** 40	1,3 **Sc** 45	1,5 **Ti** 48	1,6 **V** 51	1,6 **Cr** 52	1,5 **Mn** 55	1,8 **Fe** 56	1,8 **Co** 59	1,8 **Ni** 59	1,9 **Cu** 63,5	1,6 **Zn** 65	1,6 **Ga** 70	1,8 **Ge** 73	2,0 **As** 75	2,4 **Se** 79	2,8 **Br** 80	**Kr** 84
0,8 **Rb** 86	1,0 **Sr** 88	1,2 **Y** 89	1,4 **Zr** 91	**Nb** 92	1,8 **Mo** 96	1,9 **Tc**	2,2 **Ru** 101	2,2 **Rh** 103	2,2 **Pd** 106	1,9 **Ag** 108	1,7 **Cd** 112	1,7 **In** 115	1,8 **Sn** 119	1,9 **Sb** 122	2,1 **Te** 128	2,5 **I** 127	**Xe** 131
0,7 **Cs** 133	0,9 **Ba** 137	**La** 139	1,6 **Hf** 179	**Ta** 181	**W** 184	**Re** 186	**Os** 190	**Ir** 192	**Pt** 195	**Au** 197	**Hg** 201	1,8 **Tℓ** 204	1,8 **Pb** 207	1,9 **Bi** 209	2,0 **Po**	2,5 **At**	**Rn**
0,7 **Fr**	0,9 **Ra** 226	**Ac**															

KEY/*SLEUTEL*

Atomic number
Atoomgetal

Electronegativity
Elektronegatiwiteit

29
1,9 Cu
63,5

Symbol
Simbool

Approximate relative atomic mass
Benaderde relatiewe atoommassa

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**