

91165



Draw a cross through the box (☒) if you have NOT written in this booklet



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Mana Tohu Mātauranga o Aotearoa
New Zealand Qualifications Authority

Level 2 Chemistry 2025

91165 Demonstrate understanding of the properties of selected organic compounds

Credits: Four

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of the properties of selected organic compounds.	Demonstrate in-depth understanding of the properties of selected organic compounds.	Demonstrate comprehensive understanding of the properties of selected organic compounds.

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

You should attempt ALL the questions in this booklet.

A periodic table and other reference material are provided in the Resource Booklet L2–CHEMR.

If you need more room for any answer, use the extra space provided at the back of this booklet.

Check that this booklet has pages 2–16 in the correct order and that none of these pages is blank.

Do not write in any margins (✂/✂/✂). This area will be cut off when the booklet is marked.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

QUESTION ONE

(a) Six organic compounds are given in the table below.

Complete the table by drawing the structure or giving the IUPAC (systematic) name.

Compound	Structure	Name
A		ethanamine
B	$ \begin{array}{c} \text{Br} \\ \\ \text{Br}-\text{C}-\text{H} \\ \\ \text{H} \end{array} $	
C		3,3-dimethylbutanoic acid
D	$ \begin{array}{ccccccc} & \text{H} & \text{H} & \text{Br} & \text{H} & \text{H} & \text{H} \\ & & & & & & \\ \text{H} & -\text{C} & -\text{C} & -\text{C} & -\text{C} & =\text{C} & -\text{C}-\text{H} \\ & & & & & & \\ & \text{H} & \text{H} & \text{H} & & & \text{H} \end{array} $	
E		1-pentyne
F	$ \begin{array}{cccc} & \text{H} & \text{CH}_3 & \text{H} \\ & & & \\ \text{H} & -\text{C} & -\text{C} & -\text{C}-\text{H} \\ & & & \\ & \text{H} & \text{OH} & \text{H} \end{array} $	

- (b) Explain how acidified dichromate solution, $\text{Cr}_2\text{O}_7^{2-}/\text{H}^+$, can be used to distinguish between compounds G and H (below):

$ \begin{array}{c} \text{Cl} \\ \\ \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array} $	$ \begin{array}{c} \text{OH} \\ \\ \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array} $
Compound G	Compound H

In your answer:

- identify the type of reaction occurring
- include conditions required for the reaction to occur
- describe relevant observations
- draw the product formed.

*There is more space for
your answer and diagram
on the next page.*

Product formed:

- (c) Haloalkanes are useful starting materials used in the synthesis of many more complex molecules, including many pharmaceutical products.

Below are some constitutional (structural) isomers of chloropentane, $C_5H_{11}Cl$. Use these to answer parts (i) to (iii).

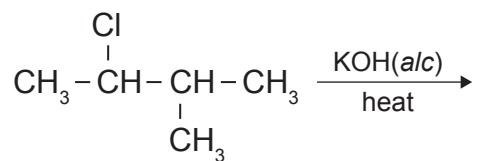
$\begin{array}{c} \text{Cl} \\ \\ \text{CH}_2 - \text{CH}_2 - \text{CH} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array}$	$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3 - \text{CH}_2 - \text{C} - \text{Cl} \\ \\ \text{CH}_3 \end{array}$
Compound G	Compound I
$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{Cl} \end{array}$	$\begin{array}{c} \text{Cl} \\ \\ \text{CH}_3 - \text{CH} - \text{CH} - \text{CH}_3 \\ \\ \text{CH}_3 \end{array}$
Compound J	Compound K

- (i) Classify each of the haloalkanes as either primary, secondary, or tertiary:

Compound G: _____ Compound I: _____

Compound J: _____ Compound K: _____

Compound K forms two different products when reacted with alcoholic potassium hydroxide, KOH(*alc*), and heat.



- (ii) Draw both products of the reaction, and circle the correct label.

Circle: MAJOR / MINOR	Circle: MAJOR / MINOR

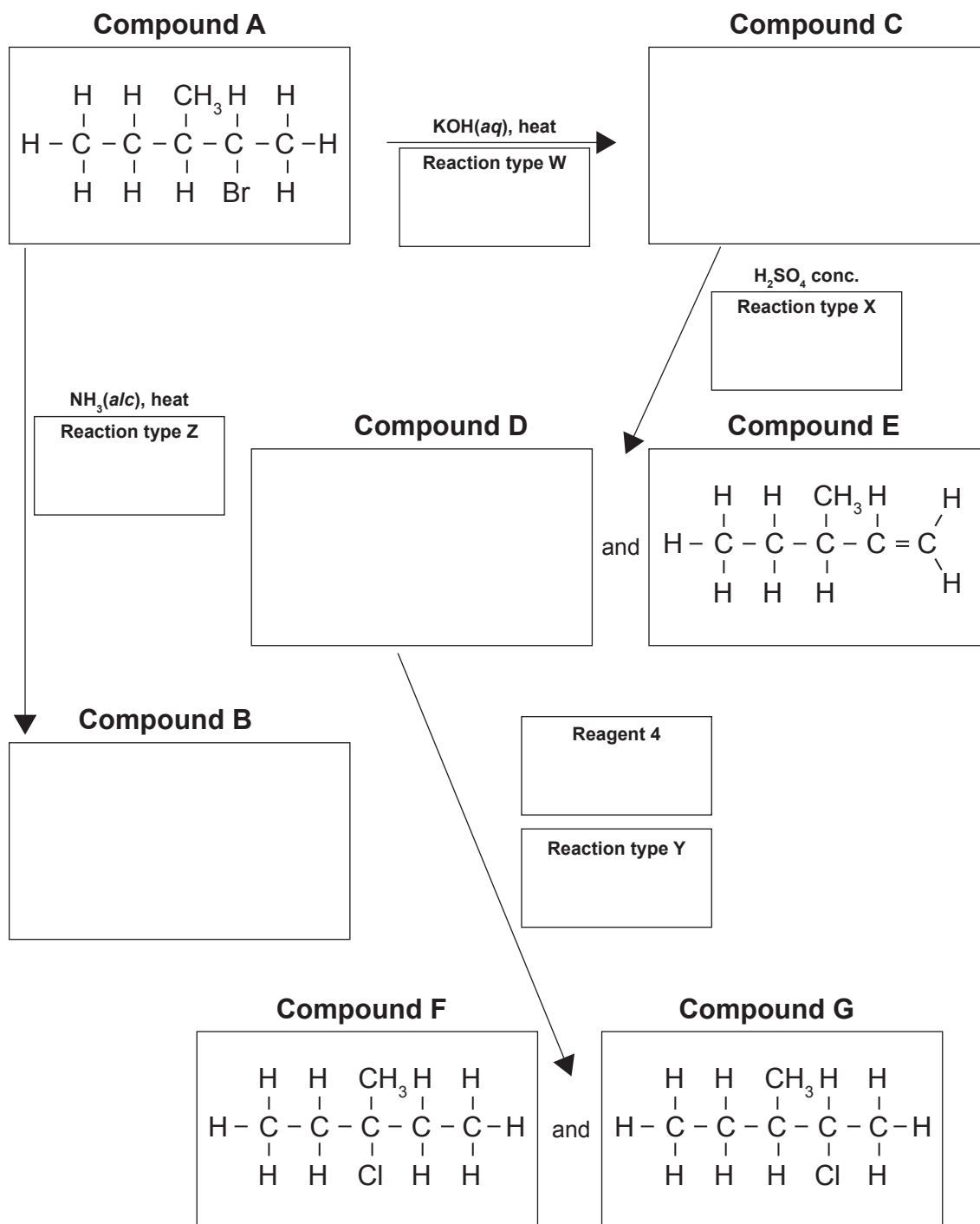
- (iii) Elaborate on the reaction of **Compound K** with alcoholic potassium hydroxide, KOH(*alc*), and heat.

In your answer:

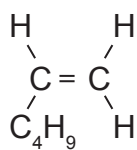
- explain why two different products are formed
- justify your choice of major and minor products.

QUESTION TWO

- (a) An incomplete reaction scheme is shown below.
- Draw the structural formulae of **Compounds B, C, and D** in the labelled boxes provided.
 - Complete the **Reaction type W, X, Y, and Z** in the labelled boxes provided.
 - Complete **Reagent 4** in the labelled box provided.



- (b) **Compound E** can be redrawn, as below, to enable it to be viewed as a monomer suitable to undergo addition polymerisation.



Compound E

- (i) Draw three repeating units of the polymer that would be produced using the monomer **Compound E** in the box below.

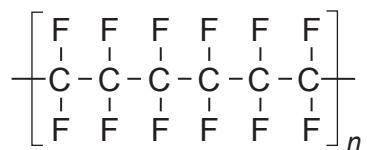
- (ii) Explain the process of addition polymerisation.

In your answer:

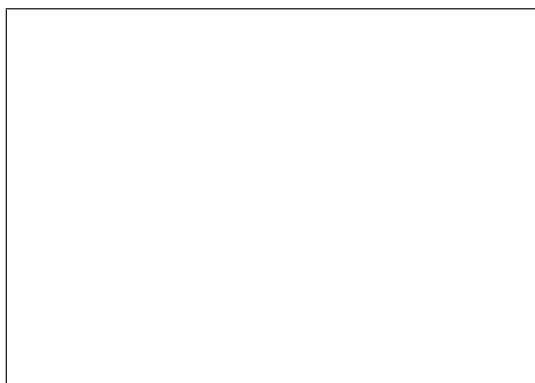
- identify the structure and bonding feature of **Compound E** that makes it suitable to undergo addition polymerisation
- explain how an addition polymerisation reaction occurs
- compare the relative reactivity of the monomer and the polymer.

Polytetrafluoroethylene, (Teflon), is a polymer known for use in breathable, waterproof textile fabrics. Alternatives are being developed that aim to provide similar advantageous properties to Teflon with less environmental impact.

The structure of Teflon is show below.



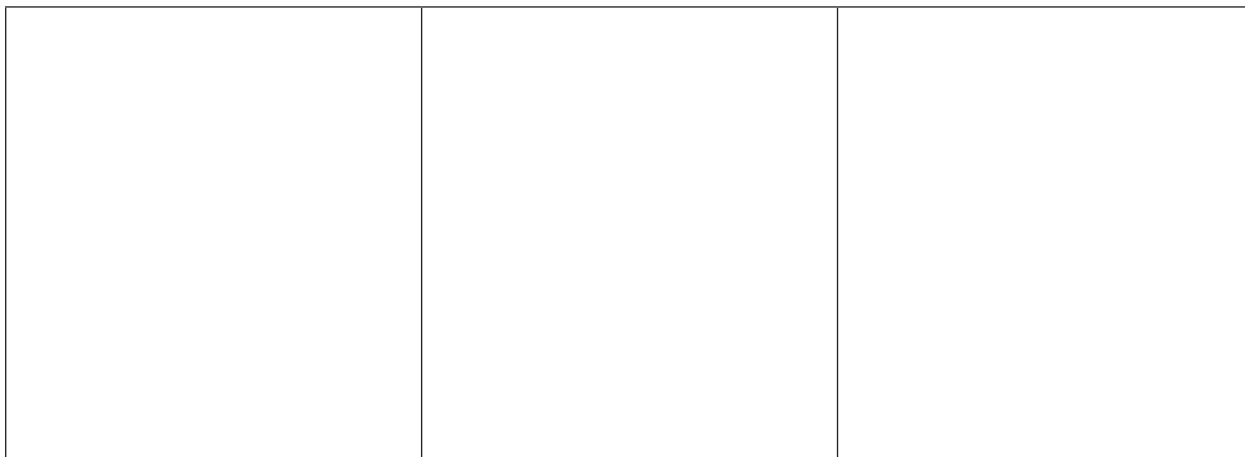
(iii) In the box below, draw the monomer that Teflon is made from.



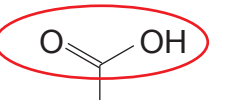
(iv) Teflon is also used as a non-stick coating on cooking pots and frying pans.

Identify the physical and chemical properties of Teflon that make it suitable for this use.

(c) Draw three straight-chain (non-branched) isomers of $\text{C}_5\text{H}_{11}\text{Cl}$.



(a) While extracting the pōhutukawa bark, the following compounds can be isolated.

	$\begin{array}{c} \text{NH}_2 \\ \\ \text{CH}_2 - (\text{CH}_2)_5 - \text{CH}_3 \end{array}$	$\begin{array}{c} \text{NH}_2 \\ \\ \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \end{array}$
gallic acid	1-heptanamine	1-propanamine

- (i) Name the functional group circled above.

- (ii) Explain the procedure you could use to distinguish between 1-heptanamine and 1-propanamine solutions based solely on their physical properties.

Physical properties are limited to differences in melting point, boiling point, and water solubility.

In your answer:

- describe the test method
- compare the observation for each compound
- explain the test result for each compound.



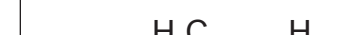
Question Three continues
on the next page.

- Include observations in your answer.

- In your answer:

- (b) Pōhutukawa flowers contain many terpene compounds (volatile organic compounds) that contribute to their fragrance. An example of a terpene, nerol, is shown below.

Two functional groups (A and B) have been circled and shown to the right, where the label 'R' has been used in place of the complex remainder of the molecule. **Note that R₁, R₂, and R₃ groups are all different.**

		
Nerol	A	B

- (i) Identify which of A and B will exist as geometric isomers.

- (ii) Justify your choice in (b)(i) by explaining the requirements for geometric isomerism.

Extra space if required.
Write the question number(s) if applicable.

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