91165

911650

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

QUALIFY FOR THE FUTURE WORLD
KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

2

SUPERVISOR'S USE ONLY

Tick this box if you have NOT written in this booklet

Level 2 Chemistry 2021

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 is 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.

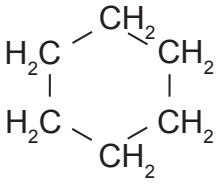
Do not write in any cross-hatched area (▨). This area may be cut off when the booklet is marked.

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

This page has been deliberately left blank.
The examination continues on the following page.

QUESTION ONE

A variety of alkanes and alkenes are shown in the table below. Refer to these compounds in order to answer parts (a) to (c).

$CH_2=CH-CH_2-CH_3$ **Compound 1**	 **Compound 2**
$CH_3-CH_2-CH=CH-CH_2-CH_3$ **Compound 3**	$CH_3-CH_2-CH_2-CH_2-CH_2-CH_3$ **Compound 4**

(a) TWO compounds in the table above are constitutional (structural) isomers of one another.

(i) Circle these two compounds below.

Compound 1 **Compound 2** **Compound 3** **Compound 4**

(ii) Justify your choices.

(b) **Compound 3** from the table can form geometric (*cis* / *trans*) isomers.

(i) Draw the geometric isomers of this compound.

***Cis* isomer**	***Trans* isomer**

(ii) Elaborate on the features of **Compound 3** that allow it to form geometric isomers.

(c) **Compound 1** and **Compound 3** will both react with hydrogen bromide, HBr. However, in one case, two organic products are formed, while in the other, only one organic product is produced.

$CH_2=CH-CH_2-CH_3$	$CH_3-CH_2-CH=CH-CH_2-CH_3$
Compound 1	**Compound 3**

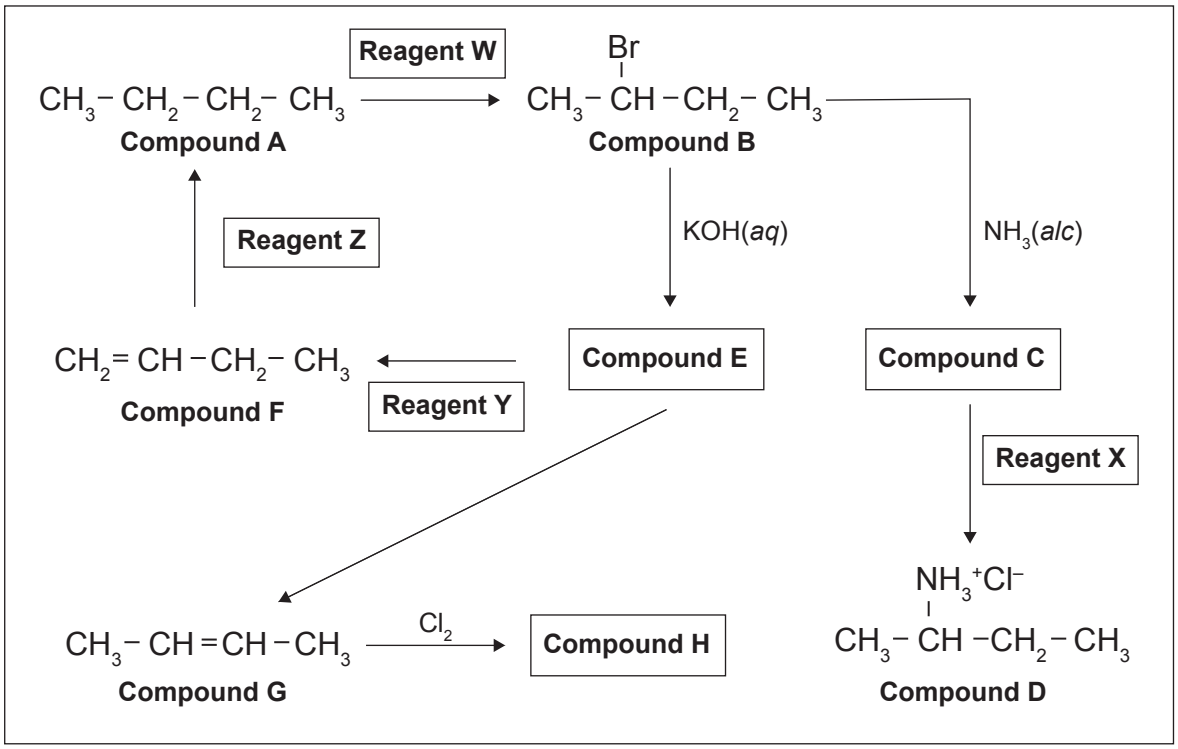
Analyse the reactions of **Compound 1** and **Compound 3** with hydrogen bromide, HBr.

In your answer you should:

- state the type of reaction occurring and justify your choice
- give the structural formulae of all products, and identify major / minor products where appropriate
- explain how the major and minor products were identified.

QUESTION TWO

(a) An incomplete reaction scheme is given below.



(i) Draw the structural formulae of **Compounds C**, **E**, and **H** in the table below.

Compound C	**Compound E**	**Compound H**

(ii) Give the formulae of **Reagents W**, **X**, **Y**, and **Z** along with any necessary conditions for **Reagents W** and **Z**.

	Formula of reagent	**Conditions required**
Reagent W		
Reagent X		
Reagent Y		
Reagent Z		

(b) Refer to the reaction scheme in part (a) for parts (i) and (ii) below.

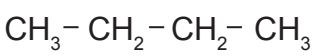
Compound F can undergo addition polymerisation reactions.

$$CH_2 = CH - CH_2 - CH_3$$

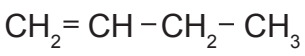
Compound F

(i) Draw THREE repeat units of the polymer formed from **Compound F**.

(ii) **Compound A** cannot undergo addition polymerisation.



Compound A



Compound F

Explain the differences in both the structure and reactivity of **Compounds A** and **F** to account for this.

In your answer you should:

- explain the term addition polymerisation
- identify any differences in the structures of **Compounds A** and **F** and link this to the difference in reactivity discussed above.

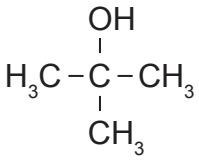
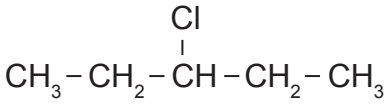
(c) Complete the following table.

Compound	IUPAC (systematic name)
$CH_3-CH_2-NH_2$	
	2,2-difluorobutane
	3-methylbutanoic acid
$CH_3-CH_2-\underset{\displaystyle CH_2}{\underset{\displaystyle \vert}{\underset{\displaystyle \vert}{CH}}}-CH_2-CH_3$ $\vert$ CH_3	

QUESTION THREE

(a) The names and condensed structures of several alcohols and haloalkanes are given in the table below.

(i) Complete the table by classifying each as primary, secondary, or tertiary alcohols / haloalkanes.

Compound	Structure	Classification (primary, secondary, or tertiary)
propan-1-ol	$CH_3-CH_2-CH_2-OH$	
methylpropan-2-ol		
3-chloropentane		
ethanol	CH_3-CH_2-OH	

(ii) Explain the difference in classification of propan-1-ol compared with methylpropan-2-ol.

(b) Explain how you could distinguish between the following pairs of compounds using their chemical properties.

Include observations and the structural formulae of any organic product(s).

Chemical identification is limited to the use of bromine water solution, $Br_2(aq)$, OR aqueous acidified potassium permanganate, $KMnO_4/H^+(aq)$.

(i) propan-1-ol and 3-chloropentane

(ii) propan-1-ol and pent-1-ene ($CH_2{=}CHCH_2CH_2CH_3$)

Question Three continues on the next page.

(c) Devise a procedure you could use to distinguish between ethanol, propan-1-ol, and pent-1-ene, using only their physical properties.

Physical identification is limited to differences in melting point, boiling point, or solubility.

All three substances are liquids at room temperature.

(d) When KOH is used as a reagent, 3-chloropentane can undergo two different types of reactions, depending on the conditions used.

Give an account of the chemical process that occurs in each reaction.

In your answer you should:

- state the conditions required for each reaction
- give the structural formulae of the organic products for each reaction
- identify the type of reaction occurring in each case, and justify your choice.

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

QUESTION NUMBER

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

QUESTION NUMBER

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

QUESTION NUMBER