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2

91165M



911655



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

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Tohua tēnei pouaka mēnā  
KĀORE koe i tuhi kōrero ki  
tēnei pukapuka

## Mātai Matū, Kaupae 2, 2022

### 91165M Te whakaatu māramatanga ki ngā āhuatanga o ētahi pūhui whaiwaro

Ngā whiwhinga: E whā

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ngā āhuatanga o ētahi pūhui whaiwaro.	Te whakaatu māramatanga ki ngā āhuatanga o ētahi pūhui whaiwaro, kia hōhonu.	Te whakaatu māramatanga ki ngā āhuatanga o ētahi pūhui whaiwaro, kia tōtōpū.

Tirohia kia kitea ai e rite ana te Tau Ākonga ā-Motu (NSN) kei runga i tō puka whakauru ki te tau kei runga i tēnei whārangi.

**Me whakamātau koe i ngā tūmahi KATOĀ kei roto i tēnei pukapuka.**

He taka pūmotu kua takoto ki te Pukapuka Rauemi L2-CHEMR.

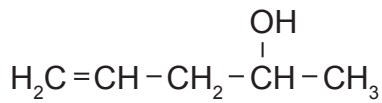
Ki te hiahia wāhi atu anō koe mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka.

Tirohia kia kitea ai e tika ana te raupapatanga o ngā whārangi 2–31 kei roto i tēnei pukapuka, ka mutu, kāore tētahi o aua whārangi i te takoto kau.

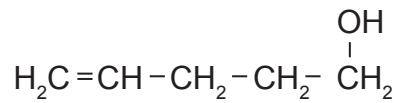
Kaua e tuhi ki tētahi wāhi e kitea ai te kauruku whakahāngai (X). Ka poroa pea taua wāhi ka mākahia ana te pukapuka.

**HOATU TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE Ā TE MUTUNGA O TE WHAKAMĀTAUTAU.**

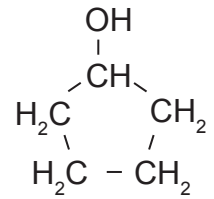
## TE TŪMAHI TUATAHI



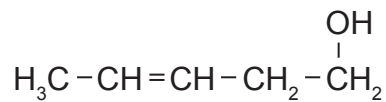
Pūhui A



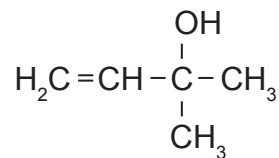
Pūhui B



Pūhui C



Pūhui D



Pūhui E

- (a) (i) E taea ana ngā pūhui o runga nei te whakarōpū hei waipiro tuatahi, hei waipiro tuarua rānei, hei waipiro tuatoru rānei.

Homai tētahi tauira KOTAHI mō IA whakarōpūtanga mā te tuhi i te reta o te pūhui ki te pouaka e hāngai ana i raro iho nei.

Waipiro tuatahi	Waipiro tuarua	Waipiro tuatoru

- (ii) Whakamāramahia mai tō kōwhiringa mō te waipiro tuarua.

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- (iii) Porohitatia te momo poinanaha e ora ana i waenga i te **B** me te **C** o ngā **Pūhui**.

poinanaha hanganga

poinanaha āhuahanga

Whakamāramahia mai tō kōwhiringa.

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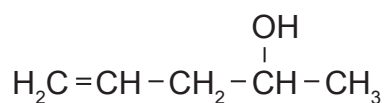


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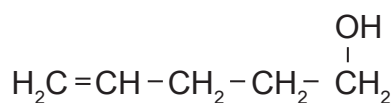


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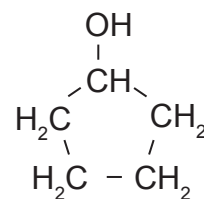
## QUESTION ONE



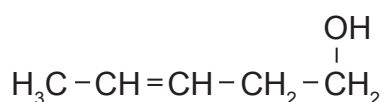
Compound A



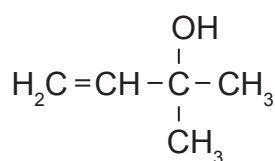
Compound B



Compound C



Compound D



Compound E

- (a) (i) The above compounds can be classified as either primary, secondary, or tertiary alcohols.

Give ONE example of EACH classification by writing the letter of the compound in the appropriate box below.

Primary alcohol	Secondary alcohol	Tertiary alcohol

- (ii) Explain your choice for the secondary alcohol.

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- (iii) Circle the form of isomerism that exists between **Compounds B** and **C**.

**constitutional (structural) isomerism**

**geometric isomerism**

Explain your choice.

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- (b) When **Compound C** is reacted with bromine water,  $\text{Br}_2(aq)$ , it reacts differently to the other compounds (**Compounds A, B, D, and E**) shown on page 2.

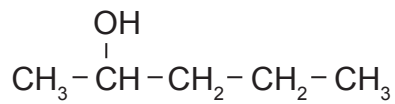
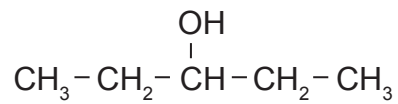
Compare and contrast the reaction between **Compound C** and  $\text{Br}_2(aq)$  with the other compounds and  $\text{Br}_2(aq)$ .

In your answer you should:

- name and justify the types of reaction taking place
- state any conditions required
- state the expected observations.

*You do not need to draw the product of any reaction in your answer.*

- (c) Ka tauhohe te **F** me te **G** o ngā **Pūhui** ki te waikawa pungatara kukū, te  $\text{H}_2\text{SO}_4(\text{conc.})$  i roto i tētahi tauhohenga tangohanga.

**Pūhui F****Pūhui G**

Ka whakaputaina e **Pūhui F** ngā hua e rua, ā, ka kotahi anake te hua ka whakaputaina e **Pūhui G**.

- (i) Homai te ture tātai hanganga o te/ngā hua mō ia tauhohenga tangohanga.

$$\begin{array}{c} \text{OH} \\ | \\ \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \end{array}$$
**Pūhui F**

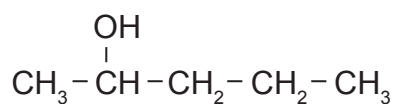
Te hua tangohanga nui

Te hua tangohanga iti

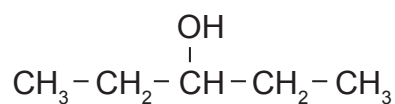
$$\begin{array}{c} \text{OH} \\ | \\ \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{CH}_3 \end{array}$$
**Pūhui G**

Te hua tangohanga

- (c) **Compounds F** and **G** both react with concentrated sulfuric acid,  $\text{H}_2\text{SO}_4(\text{conc.})$  in an elimination reaction.



**Compound F**



**Compound G**

**Compound F** will produce two products, while **Compound G** will produce only one product.

- (i) Give the structural formula of the product(s) for each elimination reaction.

<div style="border: 1px solid black; padding: 10px; display: inline-block;"> <math display="block">\begin{array}{c} \text{OH} \\   \\ \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \end{array}</math> <p><b>Compound F</b></p> </div>		<div style="border: 1px solid black; height: 100px; margin-bottom: 10px;"></div> <p style="text-align: center; margin-top: -10px;">Major elimination product</p> <div style="border: 1px solid black; height: 100px;"></div> <p style="text-align: center; margin-top: -10px;">Minor elimination product</p>
<div style="border: 1px solid black; padding: 10px; display: inline-block;"> <math display="block">\begin{array}{c} \text{OH} \\   \\ \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{CH}_3 \end{array}</math> <p><b>Compound G</b></p> </div>		<div style="border: 1px solid black; height: 100px;"></div> <p style="text-align: center; margin-top: -10px;">Elimination product</p>

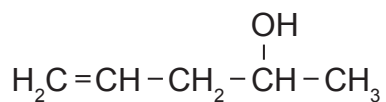
- I tō tuhinga, me parahau koe i tō kōwhiringa o ngā hua nui me ngā hua iti.



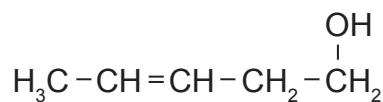
- (ii) With reference to their structures, explain why **Compound F** produces two products, while **Compound G** produces one product.

In your answer, you should justify any choice of major and minor products.

## TE TŪMAHI TUARUA



## Pūhui A



## Pūhui D

- (a) Kei roto i te **A** me te **D** o ngā **Pūhui** tētahi hononga huirua waro-warō, engari taea ai e te kotahi anake te waihanga poinanaha (*cis/trans*) ā-āhuahanga.
- (i) Porohitatia te pūhui waihanga poinanaha ā-āhuahanga.

## Pūhui A

## Pūhui D

- (ii) Tāngia ngā pōinanaha e rua ka waihangahia e ia āhuahanga ki ngā pouaka i raro nei.


poinanaha <i>cis</i>	poinanaha <i>trans</i>

- (iii) Whakamāramahia mai te take ka taea e tētahi o ēnei pūhui kotahi anake te waihanga poinanaha ā-āhuahanga.

I tō tuhinga, me:

- whakaahua ngā whakaritenga mō te pōinanaha ā-āhuahanga
- whakamārama te hiranga o te hononga huirua  $C=C$
- kōrero mō ngā hanganga o ia pūhui.

- $$\text{H}_2\text{C}=\text{CH}-\text{CH}_2-\text{CH}_2-\overset{\text{OH}}{\underset{|}{\text{CH}_2}} \xrightarrow{\text{wera / whākōkī}} \text{Waerau H}$$
- Pūhui B**

- 

$$\text{H}_2\text{C}=\text{CH}-\text{CH}_2-\overset{\text{OH}}{\underset{|}{\text{CH}}}-\text{CH}_3$$

**Compound A**

$$\text{H}_3\text{C}-\text{CH}=\text{CH}-\text{CH}_2-\overset{\text{OH}}{\underset{|}{\text{CH}_2}}$$

**Compound D**

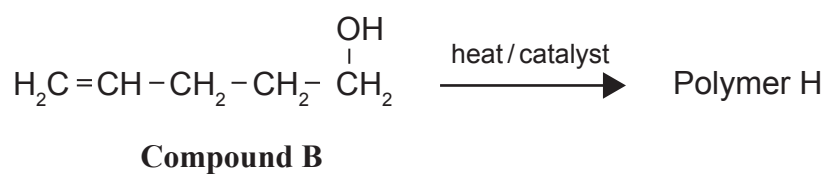
(i) Circle which compound can form geometric isomers.

### Compound D

<i>cis</i> isomer	<i>trans</i> isomer

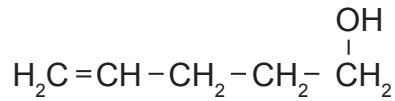
In your answer you should:

(b) **Compound B** is able to form **Polymer H**, as shown below.

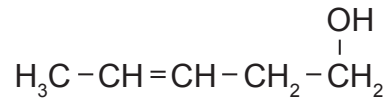


(i) Draw TWO repeating units of **Polymer H**.

- (ii) Marohitia tētahi raupapa tauhohenga hei whakawhiti i te **Pūhui B** hei **Pūhui D**.



## Pūhui B

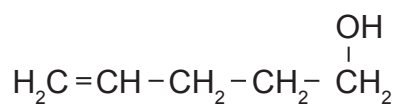


## Pūhui D

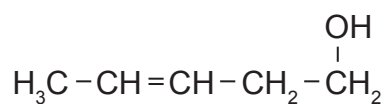
I tō tuhinga, me:

- homai ngā whakahohe i whakamahia mō te/ngā upane i te kōtuitanga matū, ka mutu, me homai hoki ngā āhuatanga e tika ana
- tuhi te momo tauhohe kei te puta i ia upane
- tautuhi ngā hua nui/iti ka waihangahia.

(ii) Propose a series of reactions to convert **Compound B** into **Compound D**.



### Compound B



### Compound D

In your answer you should:

- give the reagents used for any step(s) in the chemical synthesis along with any necessary conditions
- state the type of reaction occurring in each step
- identify any major/minor products formed.

## TE TŪMAHI TUATORU

(a) E rārangi mai ana i te tūtohi i raro nei ngā tūmomo pūhui whaiwaro.

(i) Whakaotia te tūtohi e whai ake nei mā te tuhi i te hanganga, mā te homai rānei i te ingoa pūnahanaha IUPAC mō ngā **Pūhui I–L**.

Te pūhui	Te hanganga	Te ingoa pūnahanaha IUPAC
<b>I</b>		waihā ewaro
<b>J</b>	$\begin{array}{c} \text{NH}_2 \\   \\ \text{H}_3\text{C}-\text{CH}-\text{CH}_3 \end{array}$	
<b>K</b>		waikawa <i>methylpropanoic</i>
<b>L</b>	$\begin{array}{c} \text{CH}_3 \\   \\ \text{H}_3\text{C}-\text{CH}-\text{CH}-\text{CH}_3 \\   \\ \text{CH}_3 \end{array}$	

(ii) Me hanga he huarahi mō te whiriwhiri i waenga i ngā pūhui kei te tūtohi i runga ake nei (**Ngā Pūhui I–L**) mā te whakamahi i te mehanga waiwai o te konurehu ā-pākatirua pūmura kua whakawaikawatia, i te  $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}^+(\text{aq})$ , me te totoka o te konutai pākawa waro, me te  $\text{Na}_2\text{CO}_3(\text{s})$ . I te pāmahana o te rūma, he wē ngā matū katoa.

I tō tuhinga, me:

- tuhi ngā kitenga
- hono ō kitenga ki ngā āhuatanga o te matū, o te ōkiko rānei i te rāpoi ngota whaiwaro
- homai te ture tātai hanganga o te hua whaiwaro o te/ngā tauhohe matū ka puta.

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- (iii) Marohitia tētahi atu whakamātautau hei whiriwhiri i waenga i te **Pūhui J** me te **Pūhui K** i roto i te tūtohi.

Tuhia mai ngā kitenga ka puta.

### QUESTION THREE

(a) An assortment of organic compounds are listed in the table below.

- (i) Complete the following table by drawing the structure or giving the IUPAC (systematic name) for **Compounds I–L**.

Compound	Structure	IUPAC (systematic name)
<b>I</b>		ethanol
<b>J</b>	$\begin{array}{c} \text{NH}_2 \\   \\ \text{H}_3\text{C}-\text{CH}-\text{CH}_3 \end{array}$	
<b>K</b>		methylpropanoic acid
<b>L</b>	$\begin{array}{c} \text{CH}_3 \\   \\ \text{H}_3\text{C}-\text{CH}-\text{CH}-\text{CH}_3 \\   \\ \text{CH}_3 \end{array}$	

- (ii) Devise a method for distinguishing between the compounds in the table above (**Compounds I–L**) using aqueous acidified potassium dichromate solution,  $\text{K}_2\text{Cr}_2\text{O}_7/\text{H}^+(\text{aq})$ , and solid sodium carbonate,  $\text{Na}_2\text{CO}_3(\text{s})$ . All substances are liquids at room temperature.

In your answer you should:

- state any observations
- link your observations to the chemical or physical properties of the organic molecule
- give the structural formula of the organic product of any chemical reaction(s) that occur.

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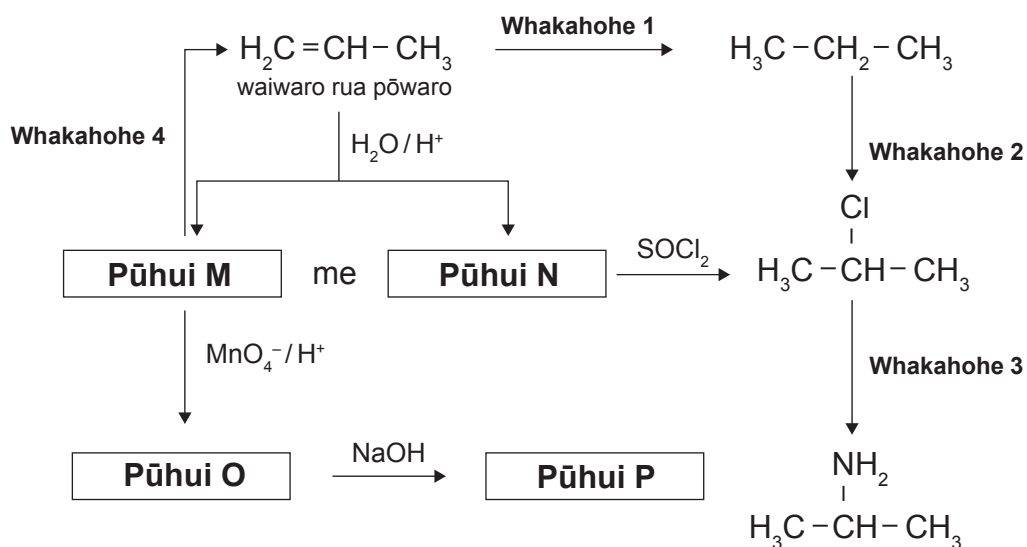
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- State any observations that would occur.

- (b) E whakaaturia ana i raro nei tētahi hoahoa tauhohenga kāore anō kia oti, e tīmata ana ki te waiwaro rua pōwaro.

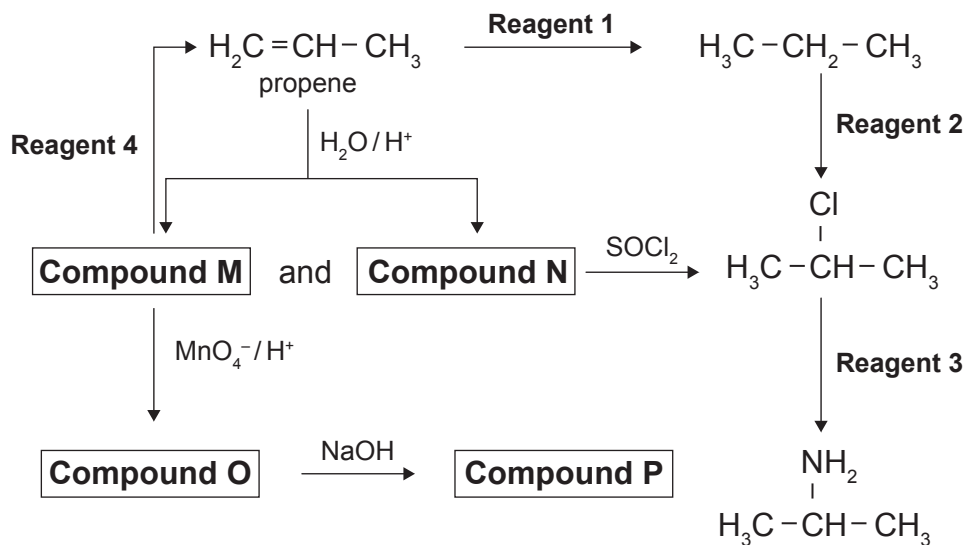


- (i) Whakaotia te hoahoa mā te homai i ngā hanganga mō ngā Pūhui M–P me ngā Whakahohe 1–4 ki ngā tūtohi i raro nei. Me homai ngā āhuatanga i ngā wāhi e tika ana.

Pūhui M	Pūhui N
Pūhui O	Pūhui P

Whakahohe 1	
Whakahohe 2	
Whakahohe 3	
Whakahohe 4	

(b) An incomplete reaction scheme, starting with propene, is shown below.



(i) Complete the scheme by giving the structures of **Compounds M–P** and **Reagents 1–4** in the tables below. Give conditions where necessary.

<b>Compound M</b>	<b>Compound N</b>
<b>Compound O</b>	<b>Compound P</b>

<b>Reagent 1</b>	
<b>Reagent 2</b>	
<b>Reagent 3</b>	
<b>Reagent 4</b>	



- (ii) **Compounds M and N** both form when propene reacts with  $\text{H}_2\text{O}/\text{H}^+$ , as shown in the previous reaction scheme.

Explain which compound forms in the greater amount.

Refer to the structure of propene in your answer.

**He whārangi anō ki te hiahiatia.  
Tuhia te tau tūmahi mēnā e hāngai ana.**

TE TAU  
TŪMAHI



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

QUESTION  
NUMBER

**He whārangi anō ki te hiahiatia.  
Tuhia te tau tūmahi mēnā e hāngai ana.**

TE TAU  
TŪMAHI

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

QUESTION  
NUMBER

*English translation of the wording on the front cover*

## Level 2 Chemistry 2022

### 91165M Demonstrate understanding of the properties of selected organic compounds

Credits: Four

91165M

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 2–27 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.**