

91165



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Level 2 Chemistry 2022

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.

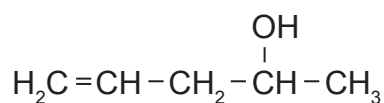
If you need more room for any answer, use the extra space provided at the back of this booklet.

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

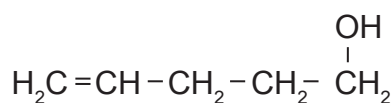
Do not write in any cross-hatched area (///). This area may be cut off when the booklet is marked.

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

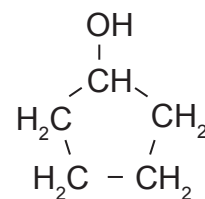
QUESTION ONE



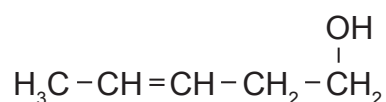
Compound A



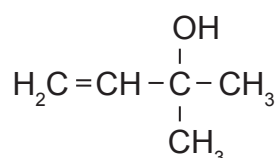
Compound B



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.

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

constitutional (structural) isomerism

geometric isomerism

Explain your choice.

- (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 opposite.

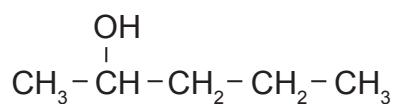
Compare and contrast the reaction between **Compound C** and $\text{Br}_2(aq)$ with the other compounds and $\text{Br}_2(aq)$.

In your answer you should:

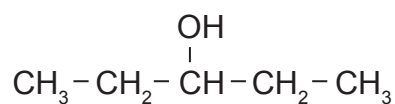
- name and justify the types of reaction taking place
- state any conditions required
- state the expected observations.

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

- (c) **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.

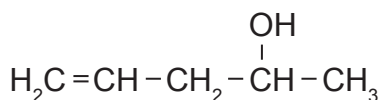
- (i) Give the structural formula of the product(s) for each elimination reaction.

$\begin{array}{c} \text{OH} \\ \\ \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3 \\ \text{Compound F} \end{array}$	}	Major elimination product
	}	Minor elimination product
$\begin{array}{c} \text{OH} \\ \\ \text{CH}_3 - \text{CH}_2 - \text{CH} - \text{CH}_2 - \text{CH}_3 \\ \text{Compound G} \end{array}$	→	Elimination product

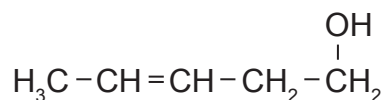
- (ii) With reference to their structures, explain why **Compound F** produces two products, while **Compound G** produces one product.

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

QUESTION TWO



Compound A



Compound D

(a) **Compounds A and D** both contain a carbon-carbon double bond, yet only one is capable of forming geometric (*cis/trans*) isomers.

(i) Circle which compound can form geometric isomers.

Compound A

Compound D

(ii) Draw the two isomers it forms in the boxes below.

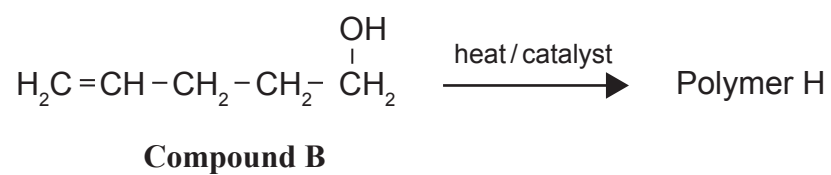
<i>cis</i> isomer	<i>trans</i> isomer
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(iii) Explain why only one of these compounds can form geometric isomers.

In your answer you should:

- describe the requirements for geometric isomerism
- explain the importance of the C=C double bond
- refer to the structures of each compound.

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



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

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The examination continues on the following page.**

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)
I		ethanol
J	$\begin{array}{c} \text{NH}_2 \\ \\ \text{H}_3\text{C}-\text{CH}-\text{CH}_3 \end{array}$	
K		methylpropanoic acid
L	$\begin{array}{c} \text{CH}_3 \\ \\ \text{H}_3\text{C}-\text{CH}-\text{CH}-\text{CH}_3 \\ \\ \text{CH}_3 \end{array}$	

(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.

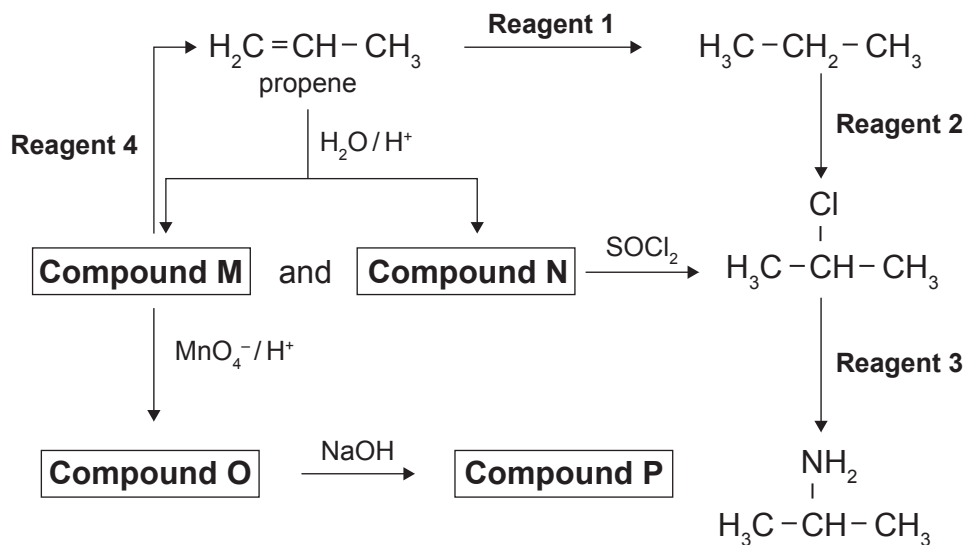
In your answer you should:

- 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.

- (iii) Propose an alternative test to distinguish between **Compound J** and **Compound K** in the table.

State any observations that would occur.

(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.

Compound M	Compound N
Compound O	Compound P

Reagent 1	
Reagent 2	
Reagent 3	
Reagent 4	

- (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.

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

QUESTION
NUMBER

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