

91391



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

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

3

SUPERVISOR'S USE ONLY

Tick this box if you  
have NOT written  
in this booklet

## Level 3 Chemistry 2022

### 91391 Demonstrate understanding of the properties of organic compounds

Credits: Five

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of the properties of organic compounds.	Demonstrate in-depth understanding of the properties of organic compounds.	Demonstrate comprehensive understanding of the properties of 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 L3-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 2–12 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.**

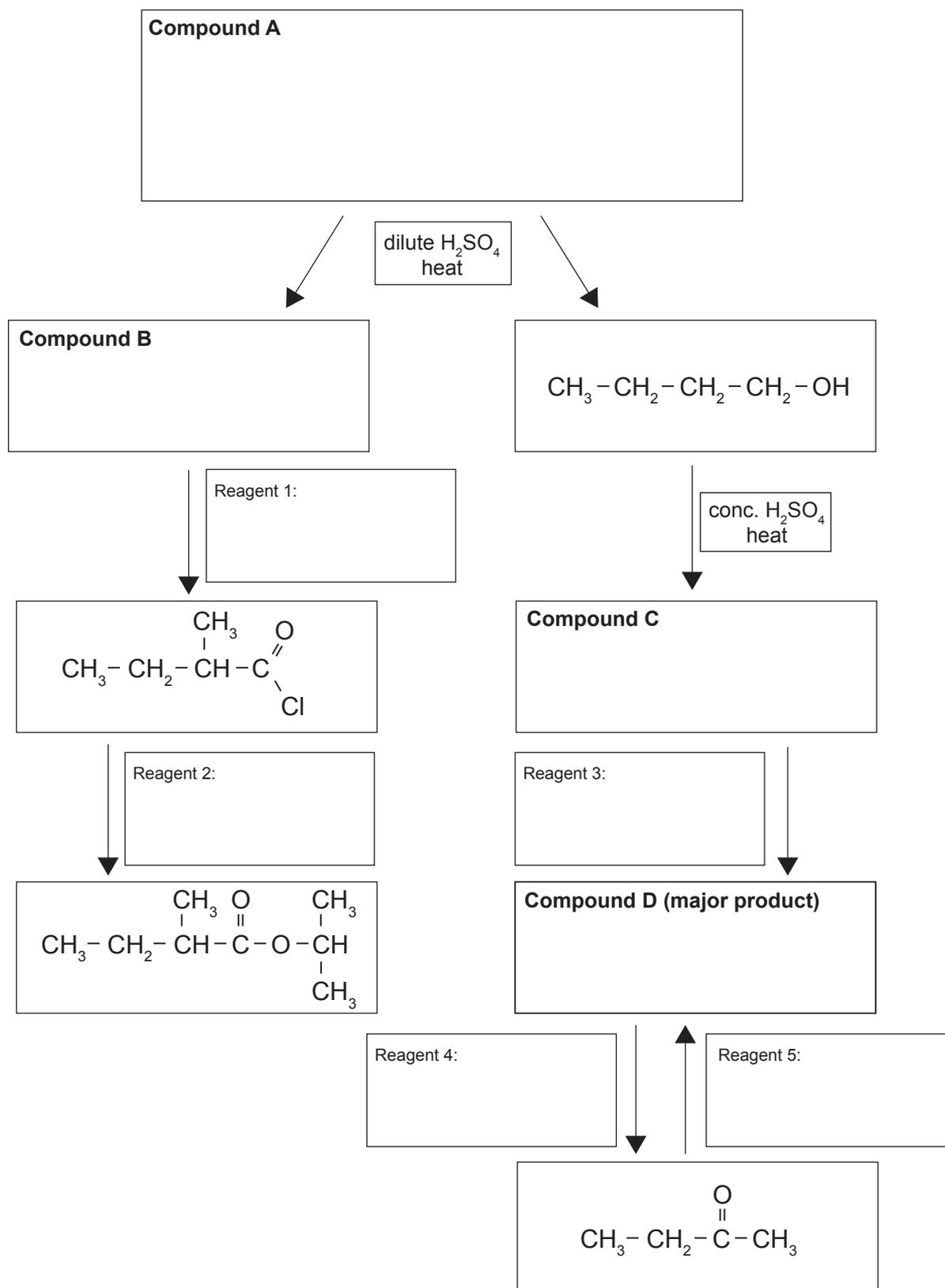
### QUESTION ONE

- (a) Complete the table below to show either the structural formula or the IUPAC (systematic) name for each organic molecule.

Structural formula	IUPAC (systematic) name
	methyl hexanoate
$\begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3 - \text{CH} - \text{C} \begin{array}{l} \nearrow \text{O} \\ \searrow \text{Cl} \end{array} \end{array}$	
	2-hydroxypentanal
$\begin{array}{c} \text{Br} \\   \\ \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{C} \begin{array}{l} \nearrow \text{O} \\ \searrow \text{NH}_2 \end{array} \end{array}$	



- (c) Complete the following reaction scheme by drawing the structural formulae for organic molecules A, B, C, and D, and identifying reagents 1, 2, 3, 4, and 5, including any necessary conditions.



**QUESTION TWO**

(a) Explain how Benedict's solution can be used to distinguish between pentanal and pentan-3-one.

Your answer should include:

- observations
- the type of reaction occurring
- structural formulae of any organic product(s).

---

---

---

---

---

---

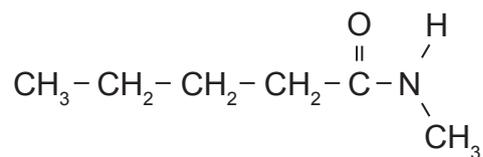
---

---

---

---

(b) Devise a reaction scheme to convert 2-bromopentane into N-methylpentanamide.

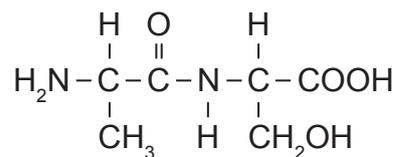


N-methylpentanamide

For each step include:

- the reagents and conditions
- the structural formula of the organic product.

(c) Dipeptides are made from two amino acids joined by an amide (peptide) bond.



- (i) Circle the amide (peptide) bond in the dipeptide shown above.
- (ii) Compare the acidic and basic hydrolysis of the above dipeptide.

Your answer should include:

- an explanation of the hydrolysis reaction
- the structural formulae of the products formed from acidic and basic hydrolysis, in the boxes provided.

---



---



---



---



---



---



---



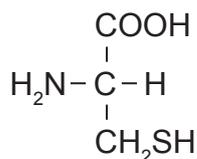
---

Products from acidic hydrolysis:

Products from basic hydrolysis:

**QUESTION THREE**

- (a) Cysteine exists as enantiomers (optical isomers).



- (i) Draw the enantiomers of cysteine in the box below:

- (ii) Explain why cysteine can exist as enantiomers.

---



---



---



---



---



---

- (b)
- Compound K**
- is a branched-chain molecule with the molecular formula
- $\text{C}_4\text{H}_9\text{OCl}$
- .
- Compound K**
- shows the following properties and reactions:

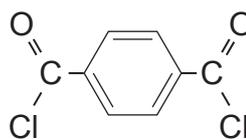
- does not exist as enantiomers (optical isomers)
- reacts with concentrated ammonia,  $\text{NH}_3$ , to form **Compound L**, which turns damp red litmus paper blue
- reacts with acidified potassium permanganate solution,  $\text{KMnO}_4/\text{H}^+$ , to form **Compound M**, which forms a silver mirror when heated with Tollens' reagent
- undergoes an elimination reaction with alcoholic potassium hydroxide,  $\text{KOH}(\text{alc})$ , to form two organic products, **Compound N** (major) and **Compound O** (minor).

Draw the structural formulae of compounds **K**, **L**, **M**, **N**, and **O** in the boxes below:

<b>Compound K</b>	
<b>Compound L</b>	
<b>Compound M</b>	
<b>Compound N</b> (major)	
<b>Compound O</b> (minor)	

*Question Three continues  
on the next page.*

- (c) Kevlar is a strong material used to make motorcycle safety clothing. The monomers used to make Kevlar are shown below:



Note:  is a benzene ring, and does not change when the monomers join together to form the polymer.

- (i) Why does each monomer need two functional groups in order for the polymer to form?

---

---

---

---

- (ii) In the box below, draw a section of the Kevlar polymer chain to show TWO repeating units.

- (iii) Identify and explain the type of reaction occurring in the formation of Kevlar.

---

---

---

---

---

---

---

---



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

QUESTION  
NUMBER

91391