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91391



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NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

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KIA NOHO TAKATŪ KI TŌ ĀMUA AO!

SUPERVISOR'S USE ONLY

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

Mātai Matū, Kaupae 3, 2022

91391M Te whakaatu māramatanga ki ngā āhuatanga o ngā pūhui whaiwaro

Ngā whiwhinga: E rima

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ngā āhuatanga o ngā pūhui whaiwaro.	Te whakaatu māramatanga ki ngā āhuatanga o ngā pūhui whaiwaro, kia hōhonu.	Te whakaatu māramatanga ki ngā āhuatanga o ngā 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 KATOA kei roto i tēnei pukapuka.

He taka pūmotu me ētahi atu rauemi tautoko kei te Pukapuka Rauemi L3-CHEMMR.

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 2–23 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

- (a) Whakaotia te tūtohi i raro iho nei hei whakaatu i te tauira tātai ā-hanga, i te ingoa (pūnahanaha) IUPAC rānei mō ia rāpoi ngota whaiwaro.

Te tauira tātai ā-hanga	Te ingoa (pūnahanaha) IUPAC
	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} $	

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} $	

- (b) Three bottles, each containing a different colourless liquid, have been packed away without being correctly labelled. The laboratory technician confirms they are:
- propanoyl chloride
 - propan-1-ol
 - propanoic acid.

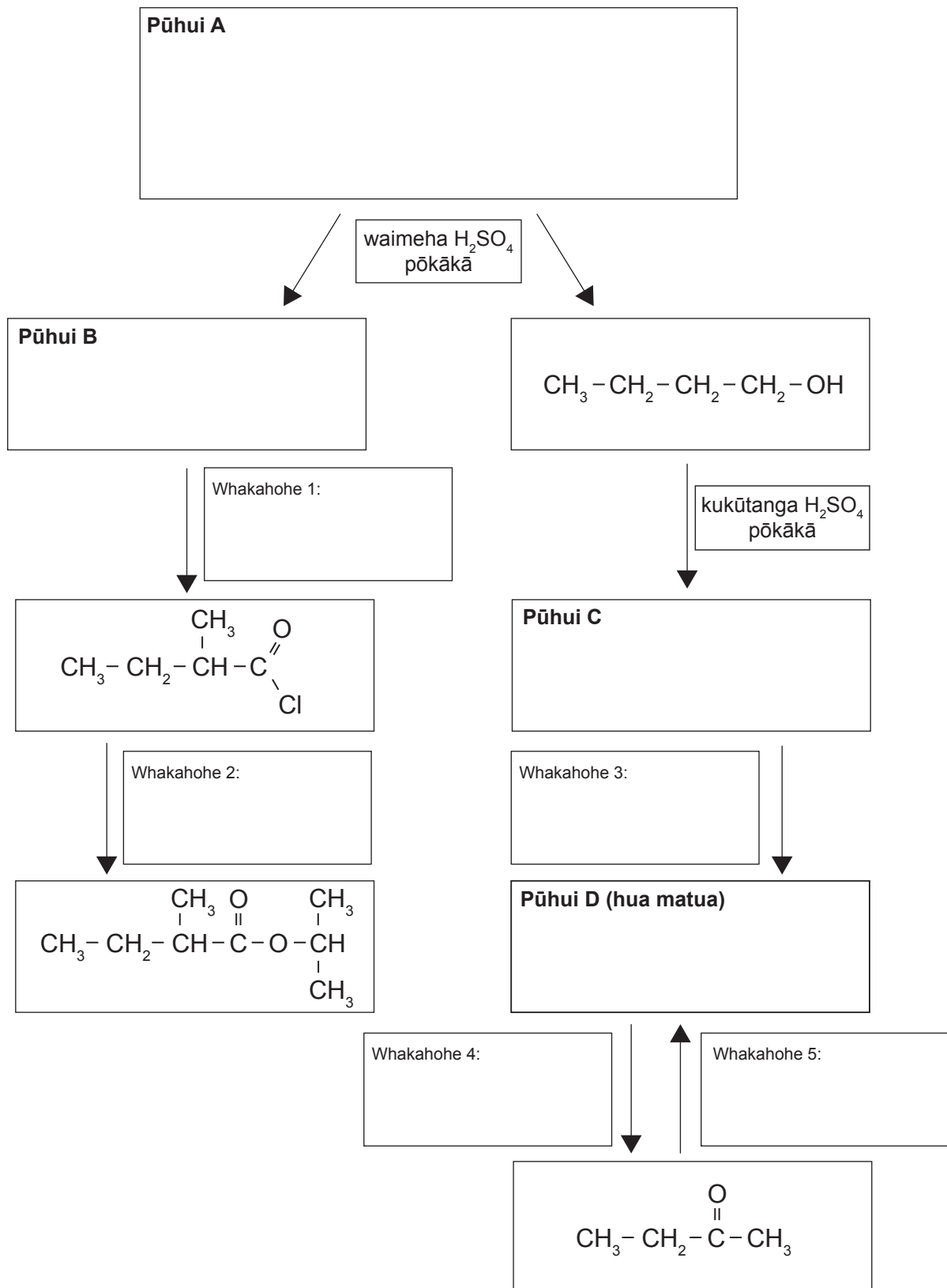
Develop a valid procedure to identify each of the three colourless liquids using only the following reagents:

- water
- litmus paper
- acidified potassium dichromate solution, $\text{Cr}_2\text{O}_7^{2-}/\text{H}^+$.

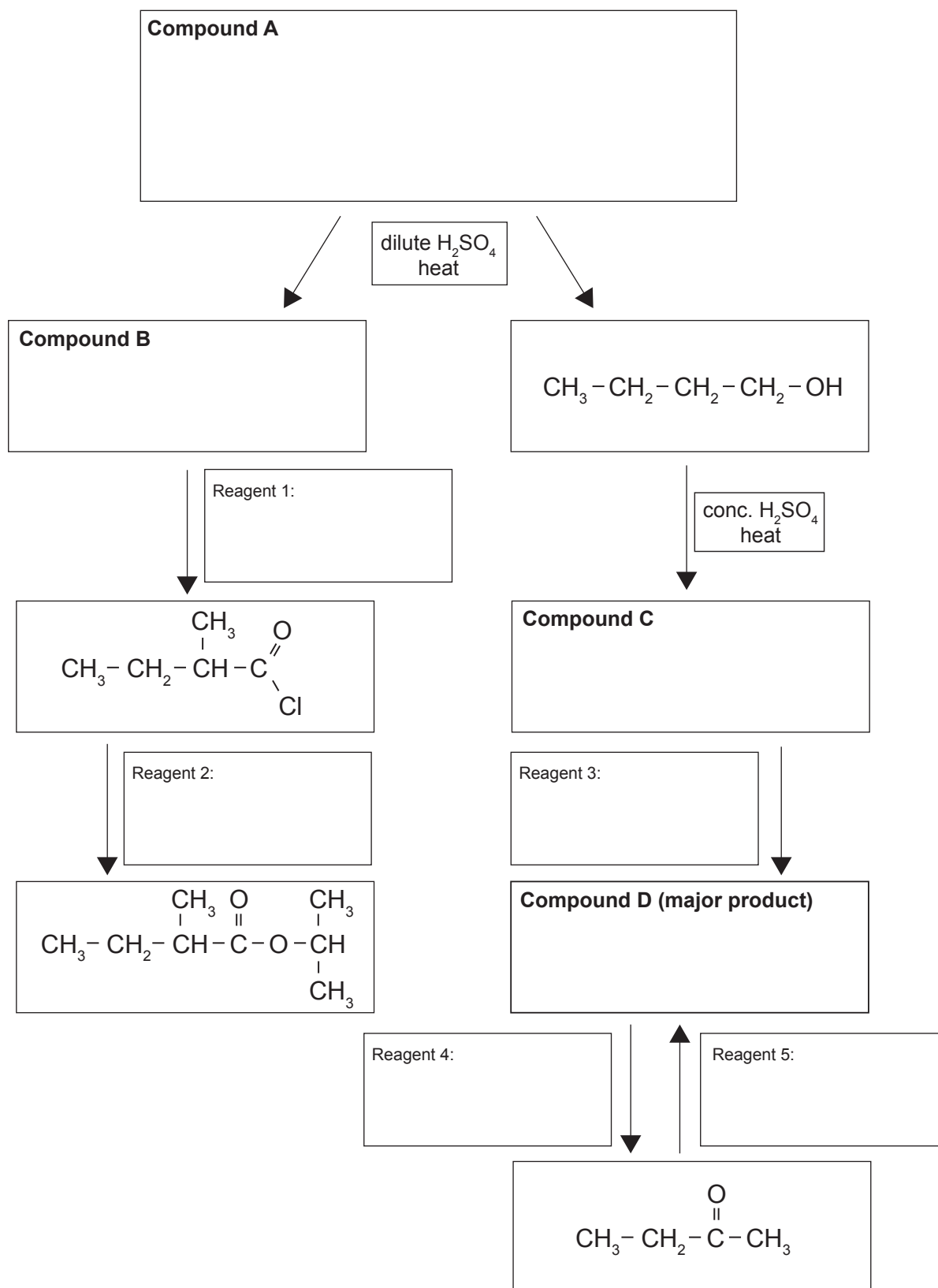
Your procedure should include:

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

- (c) Whakaotia te mahere tauhohe e whai ake nei mā te tuhi i ngā tauira tātai ā-hanga mō ngā rāpoi ngota whaiwaro A, B, C, me te D. Me tautohu hoki ngā whakahohe 1, 2, 3, 4, me te 5, me te whakauru anō i ngā āhuatanga tāpiri me mātua eke e oti ai te tauhohenga.



- (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.



TE TŪMAHI TUARUA

- (a) Whakamāramahia mai te āhua o te whakamahi i te mehanga a Benedict hei wehewehe i te *pentanal* me te *pentan-3-one*.

Me whakauru ki tō whakautu:

- ngā kitenga
- te momo tauhohenga e puta ana
- ngā tauira tātai ā-hanga o te/ngā hua whaiwaro.

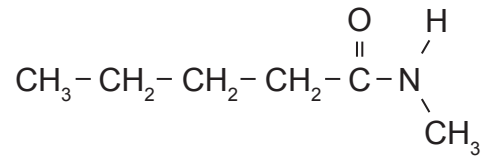
QUESTION TWO

- (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) Āta whiriwhiria tētahi mahere tauhohe hei whakawhiti i te *2-bromopentane* ki te *N-methylpentanamide*.

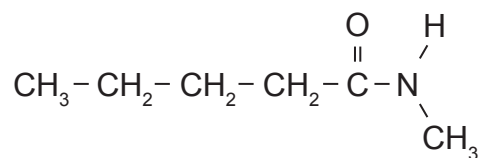


N-methylpentanamide

Mō ia wāhanga, whakaurua:

- ngā whakahohe me ngā āhuatanga tāpiri me mātua eke e oti ai te tauhohenga
- te tauira tātai ā-hanga o te hua whaiwaro.

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

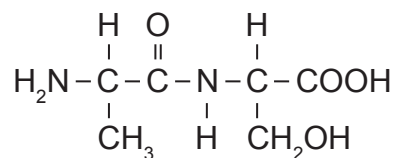


N-methylpentanamide

For each step include:

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

- (c) Ka waihangahia mai te *dipeptide* ki ngā waikawa amino e rua e honoa ana ki tētahi hononga *amide* (*peptide*).



- (i) Porohitatia te hononga *amide* (*peptide*) i roto i te *dipeptide* e whakaaturia ana i runga ake.
- (ii) Whakatairitea te wehe ā-wai waikawa me te wehe ā-wai kawakore o te *dipeptide* i runga ake nei.

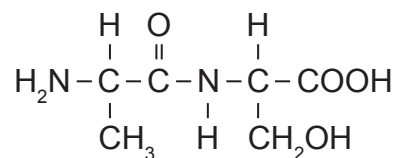
Me whakauru ki tō tuhinga:

- tētahi whakamāramatanga o te tauhohenga wehe ā-wai
- te tauira tātai ā-hanga o ngā hua ka oti mai i te wehe ā-wai i roto i te waikawa, i roto anō i te kawakore (tuhia ki ngā pouaka kei raro iho).

Ngā hua ka oti mai i te wehe ā-wai i roto i te waikawa:

Ngā hua ka oti mai i te wehe ā-wai i roto i te kawakore:

- (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:

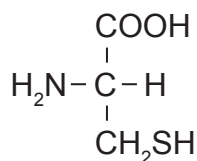
- an explanation of the hydrolysis reaction
- the structural formulae of the products formed from acidic and basic hydrolysis, in the boxes provided.

Products from acidic hydrolysis:

Products from basic hydrolysis:

TE TŪMAHI TUATORU

- (a) Ka noho mai te cysteine hei *enantiomer* (arā, hei *optical isomer*).



- (i) Tuhia ngā *enantiomer* o te *cysteine* ki te pouaka i raro iho nei:

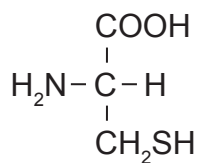
- (ii) Whakamāramahia mai te take e āhei ai te *cysteine* te noho mai hei *enantiomer*.

- (b) He rāpoi ngota mekameka-peka te **Pūhui K** ko te $\text{C}_4\text{H}_9\text{OCl}$ tōna tauira tātai rāpoi ngota. Kei te whakaatu a **Pūhui K** i ngā āhuatanga me ngā tauhohenga e whai ake nei:


- kāore i te noho hei *enantiomer* (*optical isomer*)
- ka tauhohe ki te haukini kukū, NH_3 , hei waihanga i te **Pūhui L**, e hurihia ai te pepa tohu waikawa whero haukū kia kahurangi
- ka tauhohe ki te mehanga konurehu pāporo (*potassium permanganate*) kua whakawaikawatia, KMnO_4/H^+ , e oti mai ai te **Pūhui M**; ina whakamahanatia te **Pūhui M** ki te whakahohe a Tollens, ka oti mai he whakaata hiriwa
- ka puta tētahi tauhohenga tangohanga ki te konurehu waihā waipiro, $\text{KOH}(\text{alc})$, e oti mai ai ngā hua whaiwaro e rua, te **Pūhui N** (mātuatua) me te **Pūhui O** (ririki).

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, NH_3 , to form **Compound L**, which turns damp red litmus paper blue
- reacts with acidified potassium permanganate solution, KMnO_4/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).

Tuhia ngā taurira tātai ā-hanga o ngā pūhui **K**, **L**, **M**, **N**, me te **O** ki ngā pouaka i raro iho nei:

Pūhui K	
Pūhui L	
Pūhui M	
Pūhui N (mātuatua)	
Pūhui O (ririki)	

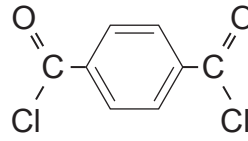
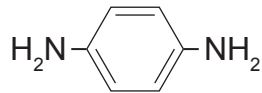
*Ka rere tonu te Tūmahi Tuatoru
i te whārangi e whai ake nei.*


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

Compound K	
Compound L	
Compound M	
Compound N (major)	
Compound O (minor)	

*Question Three continues
on the next page.*

- (c) He matū marohi te *Kevlar* ka whakamahia hei hanga kākahu haumarū mō te eke motopaika. E whakaaturia ana i raro iho nei ngā waetahi ka whakamahia hei waihanga i te *Kevlar*:



He kupu tāpiri: he rīngi penehīni (*benzene*) te , ā, ka kore e panoni ka tūhonohono ana ngā waetahi ki te waihanga i te waerau.


- (i) He aha te take me rua rawa ngā rōpū hohe mō ia waetahi e waihangahia ai te waerau?

- (ii) Ki te pouaka i raro iho nei, tuhia tētahi wāhanga o te raupapa waerau *Kevlar* hei whakaatu i ngā wae tāruarua e RUA.

- (iii) Tautohua, whakamāramahia mai anō hoki te momo tauhohenga e puta ana i roto i te hanganga o te *Kevlar*.

- (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.

**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 3 Chemistry 2022

**91391M Demonstrate understanding
of the properties of organic compounds**

Credits: Five

91391M

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–CHEMMR.

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 2–23 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.