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91391M



913915



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MANA TOHU MĀTAURANGA O AOTEAROA

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SUPERVISOR'S USE ONLY

Tohua tēnei pouaka  
mēnā kāore he tuhituhi i  
roto i tēnei pukapuka

## Te Mātauranga Matū, Kaupae 3, 2020

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

2.00i te ahiahi Rāmere 27 Whiringa-ā-rangi 2020  
Ngā whiwhinga: Rima

Paetae	Kaiaka	Kairangi
Te whakaatu māramatanga ki ngā āhuatanga o ngā pūhui whaiwaro.	Te whakaatu māramatanga hōhonu ki ngā āhuatanga o ngā pūhui whaiwaro.	Te whakaatu māramatanga matawhānui ki ngā āhuatanga o ngā pūhui whaiwaro.

Tirohia mēnā 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 whakaritea ki te Pukapuka Rauemi L3-CHEMMR.

Mēnā ka hiahia whārangi atu anō koe mō ō tuinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka, ka āta tohu ai i te tau tūmahi.

Tirohia mēnā 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.

**ME HOATU RAWA KOE I TĒNEI PUKAPUKA KI TE KAIWHAKAHAERE Ā TE MUTUNGA O TE WHAKAMĀTAUTAU.**

TAPEKE

MĀ TE KAIMĀKA ANAKE

## TŪMAHI TUATAHI

- (a) (i) Whakaotia te tūtohi i raro nei hei whakaatu i te ture tātai hanganga, i te ingoa (nahanaha) IUPAC rānei mō ia rāpoi ngota whaiwaro.

Pūhui	Ingoa (nahanaha) IUPAC	Ture Tātai Hanganga
A	3-pūhaukini powaro pūhaumāota (3-chloropropanamide)	
B		$\text{CH}_3 - \overset{\text{O}}{\underset{\parallel}{\text{C}}} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$
C		$\text{CH}_3 - \text{CH}_2 - \overset{\text{O}}{\underset{\parallel}{\text{C}}} - \text{O} - \text{CH}_3$
D	2-hāparo-tahi pūwaro mewaro (2-methylbutanal)	

- (ii) Whakaahuahia mai me te whakamārama i tētahi whakamātautau matū hei wehewehe i waenga i ngā pūhui B me D mai i te tūtohi kei te wāhanga (i).

Me whakauru ki tō tuhinga:

- ngā whakahohe me ngā āhuatanga e hiahiatia ana
- ngā kitenga
- te momo tauhohenga kei te puta
- ngā tātai hanganga o tētahi/ētahi hua whaiwaro.

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# QUESTION ONE

 ASSESSOR'S  
USE ONLY

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

Compound	IUPAC (systematic) name	Structural Formula
A	3-chloropropanamide	
B		$\text{CH}_3 - \overset{\text{O}}{\underset{\parallel}{\text{C}}} - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$
C		$\text{CH}_3 - \text{CH}_2 - \overset{\text{O}}{\underset{\parallel}{\text{C}}} - \text{O} - \text{CH}_3$
D	2-methylbutanal	

- (ii) Describe and explain a chemical test to distinguish between compounds B and D from the table in part (i).

Your answer should include:

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

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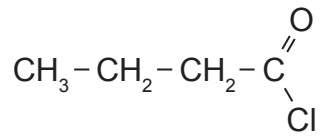
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- (b) Hangaia he mahere tauhohe hei tahuri i te 1-pūwaro pūkane ki te waikawa pūwaro pūhaumāota (butanoyl chloride).

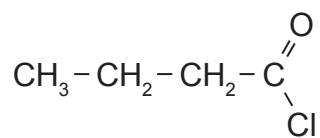


butanoyl chloride

Mō ia upane o te mahere tauhohe, me whakauru:

- ngā whakahohe me ngā āhuatanga
- te tātai hanganga o te hua whaiwaro i muri i ia upane.

- (b) Devise a reaction scheme to convert 1-bromobutane into butanoyl chloride.



butanoyl chloride

For each step of the reaction scheme, include:

- reagents and conditions
- structural formula of the organic product after each step.

(c) He rāpoi ngota mekameka-kaupekapeka a **S** te mōhiohia me te tātai rāpoi ngota  $C_5H_{10}O$ . E whakaatu ana i ngā āhuatanga me ngā tauhohenga e whai ake:

- ka whakakore tere i te tae o te wai pūkane
- ka noho hei poinanaha whakaata (enantiomer) engari kua hei poinanaha *cis-trans* (āhuahanga)
- ka tauhohe ki te mehanga konurehu konukita-rua i whakawaikawatia,  $Cr_2O_7^{2-}/H^+$ , kia puta hei Hua **T**, ā, kāore e tauhohe ki te whakahohe Benedict
- ka tauhohe ki te  $H_2O/H^+$  kia puta ai ngā hua e rua, **U** me **V**. Ko Hua **V** te hua matua.

E ai ki ngā mōhiohia i runga ake, tātuhia ngā tātai hanganga o te Hua **S** Tē Mōhiohia, me ngā Hua **T**, **U** me **V**.

Rāpoi ngota whaiwaro	Tātai hanganga
<b>S</b>	
<b>T</b>	
<b>U</b>	
<b>V</b>	

(c) Unknown **S** is a branched chain molecule with the molecular formula  $C_5H_{10}O$ . It shows the following properties and reactions:

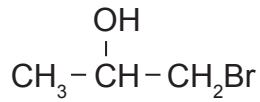
- rapidly decolourises bromine water
- exists as enantiomers (optical isomers), but does not exist as *cis-trans* (geometric) isomers
- reacts with acidified potassium dichromate solution,  $Cr_2O_7^{2-}/H^+$ , to form Product **T**, which does not react with Benedict's reagent
- reacts with  $H_2O/H^+$  to form two products, **U** and **V**. Product **V** is the major product.

Based on the information above, draw the structural formulae of Unknown **S**, and Products **T**, **U**, and **V**.

Organic molecule	Structural formula
<b>S</b>	
<b>T</b>	
<b>U</b>	
<b>V</b>	

## TŪMAHI TUARUA

- (a) Hei poinanaha whakaata (poinanaha ōmata) te 1-pūkane 2-waihā pōwaro (1-bromopropan-2-ol ).



- (i) Tātuhia ngā poinanaha whakaata o te 1-pūkane 2-waihā pōwaro ki te tapawhā i raro nei.

- (ii) He aha te take ka āhei te 1-pūkane 2-waihā pōwaro ki te noho hei poinanaha whakaata?

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- (iii) Whakamāramahia ka pēhea te wehewehe i ngā poinanaha whakaata e rua o te 1-pūkane 2-waihā pōwaro.

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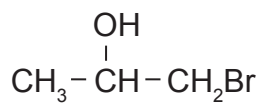
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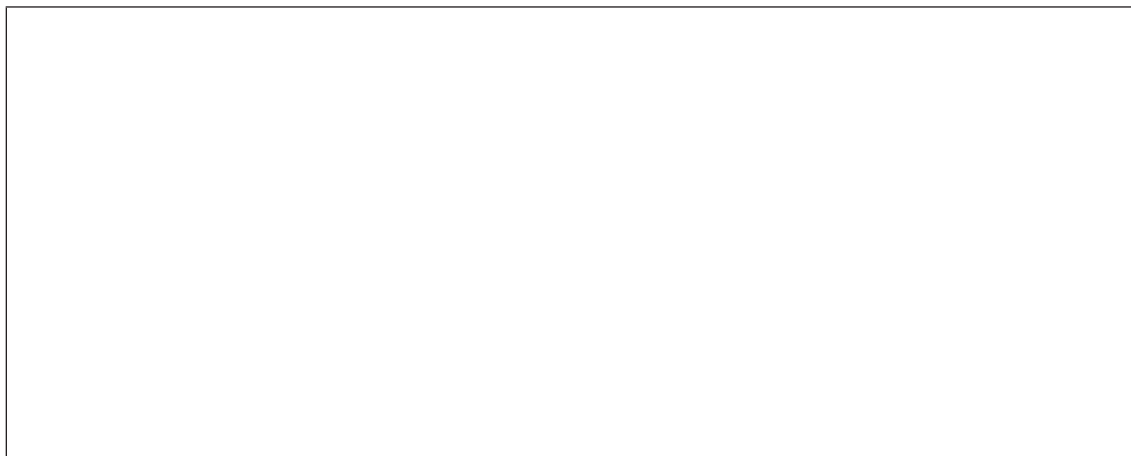


**QUESTION TWO**ASSESSOR'S  
USE ONLY

- (a) 1-bromopropan-2-ol exists as enantiomers (optical isomers).



- (i) Draw the enantiomers of 1-bromopropan-2-ol in the box below.



- (ii) Why can 1-bromopropan-2-ol exist as enantiomers?

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- (iii) Explain how the two enantiomers of 1-bromopropan-2-ol could be distinguished.

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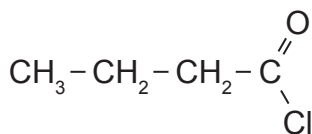
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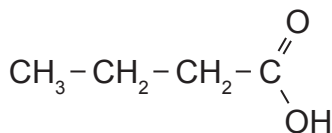
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- (b) I hē te tapa i ngā pātara e toru, ā, he wē kanokore rerekē kei roto i ia pātara. E mōhiotia ana ngā wē kanokore ko te:

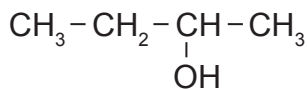
waikawa pūwaro  
pūhaumāota

$$\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{C} \begin{array}{l} \text{O} \\ \parallel \\ \text{Cl} \end{array}$$


te waikawa pūwaro

$$\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{C} \begin{array}{l} \text{O} \\ \parallel \\ \text{OH} \end{array}$$


te waihā-2-pūwaro       $\text{CH}_3 - \text{CH}_2 - \underset{\text{OH}}{\text{CH}} - \text{CH}_3$



Hangaia he hātepe hei tautohu i ia wē kanokore e toru mā te whakamahi anake i ngā whakahohe e whai ake:

- ko te mehanga konutai pākawa waro,  $\text{Na}_2\text{CO}_3$
- ko te wai,  $\text{H}_2\text{O}$
- ko te mehanga konurehu pāporo (potassium permanganate) kua whakawaikawatia,  $\text{KMnO}_4/\text{H}^+$ .

Me whakauru ki tō hātepe ko:

- ngā kitenga
- te momo tauhohenga kei te puta
- ngā tātai hanganga o ngā hua whaiwaro.

**He wāhi anō mō tō tuhinga mō  
tēnei tūmahi kei te whārangi o  
muri mai.**

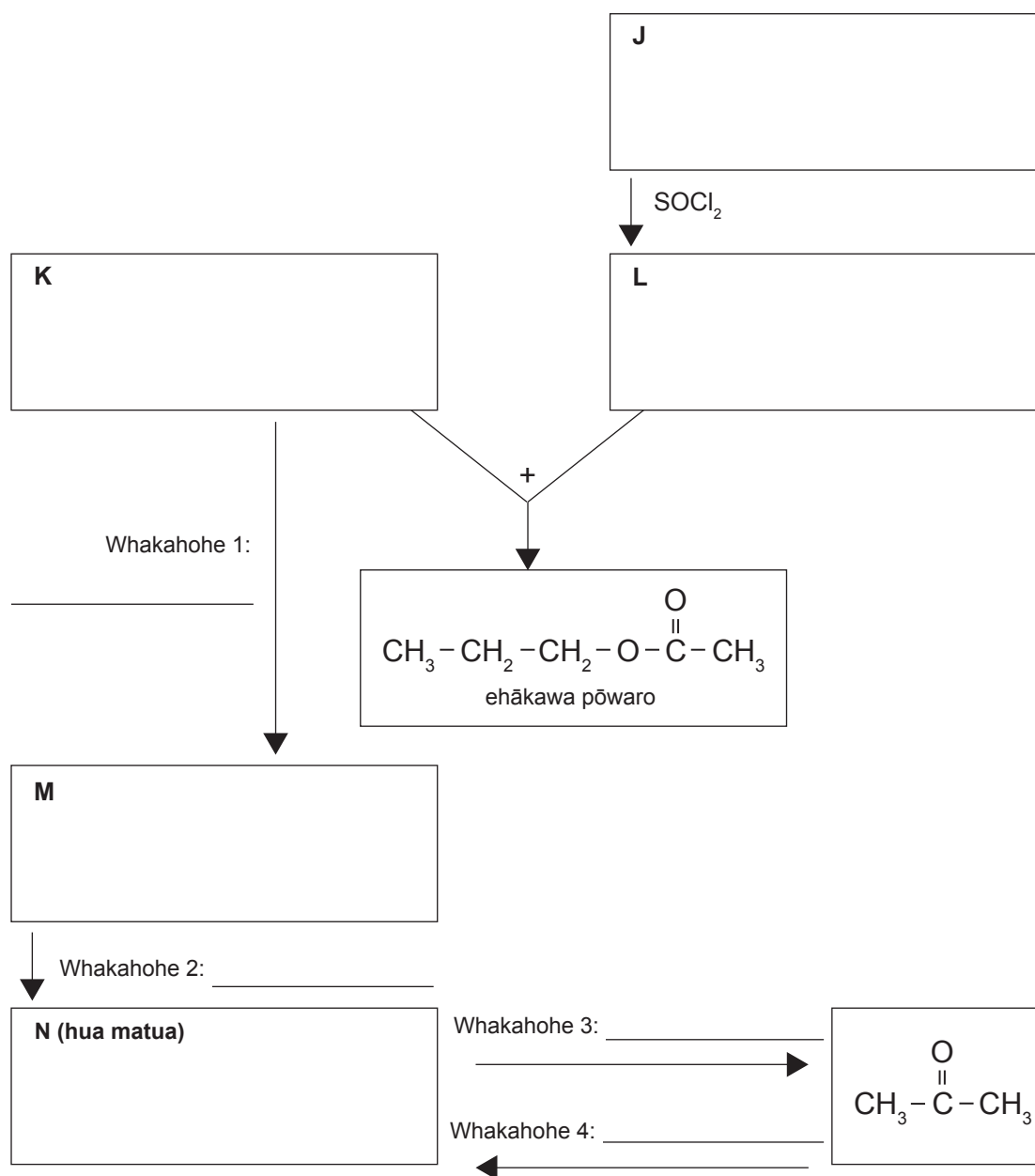
- butanoyl chloride  $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{C}(=\text{O})\text{Cl}$
- butanoic acid  $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{C}(=\text{O})\text{OH}$
- butan-2-ol  $\text{CH}_3-\text{CH}_2-\text{CH}(\text{OH})-\text{CH}_3$

- sodium carbonate solution,  $\text{Na}_2\text{CO}_3$
- water,  $\text{H}_2\text{O}$
- acidified potassium permanganate solution,  $\text{KMnO}_4/\text{H}^+$ .

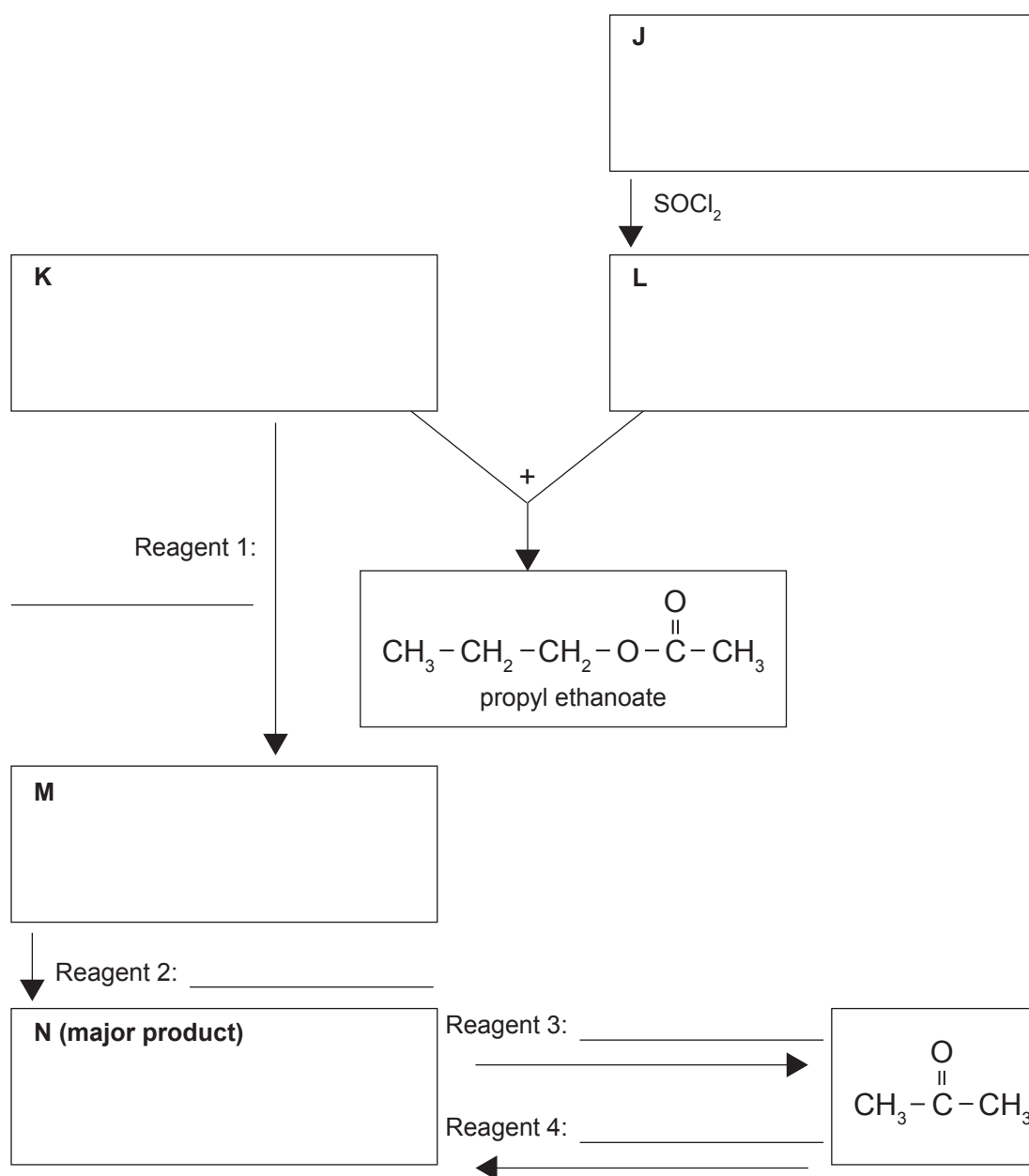
- observations
- the type of reaction occurring
- structural formulae of any organic products.

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- (c) Whakaotia te mahere tauhohe e whai ake mā te tātuhi i ngā ture tātai hanganga mō ngā rāpoi ngota whaiwaro **J**, **K**, **L**, **M**, **N**, me te tautohu i ngā whakahohe 1, 2, 3 me te 4.



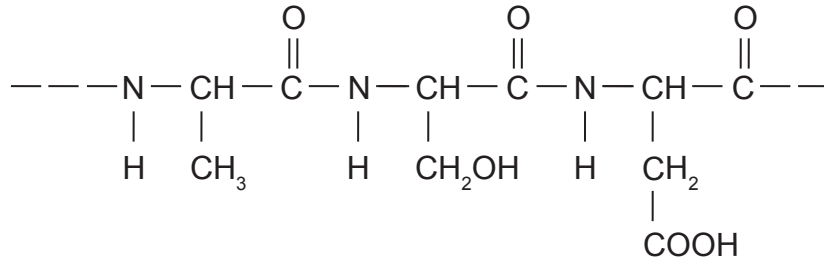
- (c) Complete the following reaction scheme by drawing the structural formulae for organic molecules **J**, **K**, **L**, **M**, **N**, and identifying reagents 1, 2, 3, and 4.



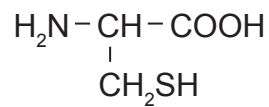
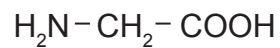
## TŪMAHI TUATORU

Ka takea mai ngā pētīnirau i ngā waikawa amino.

- (a) **Porohitatia** tētahi o ngā hononga pētini (pūhaukini) e whakaaturia ana i roto i te wāhanga o te mekameka pētīnirau i raro.



- (b) (i) Mā te whakamahi i ngā waikawa amino i raro, tātuhia ngā pētini-rua e RUA ka taea te puta ake.

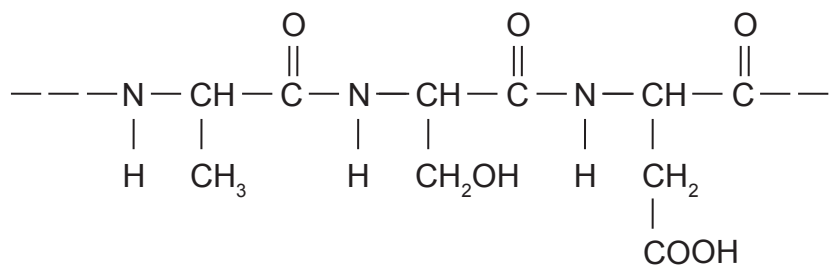



### QUESTION THREE

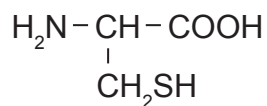
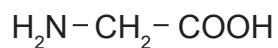
ASSESSOR'S  
USE ONLY

Polypeptides are made up of amino acids.

- (a) **Circle** one of the peptide (amide) bonds shown in the section of the polypeptide chain below.



- (b) (i) Using the following amino acids, draw the TWO possible dipeptides that could be formed.




- $$\begin{array}{ccccccc} & & \text{O} & & & & \\ & & \parallel & & & & \\ \text{H}_2\text{N}-\text{CH}-\text{C}-\text{N}-\text{CH}-\text{COOH} \\ | & & & | & & | & \\ \text{CH}_3 & & & \text{H} & & \text{CH}_2\text{OH} & \end{array}$$

- te whakaahuatanga o tētahi tauhohenga whakapaheko ā-wai
- ngā whakahohe me ngā āhuatanga e hiahiatia ana
- ngā ture tātai hanganga o ngā hua ka puta mai i te whakapaheko ā-waikawa ME te whakapaheko ā-kawakore.

Ngā hua ka puta mai i te whakapaheko ā-waikawa	Ngā hua ka puta mai i te whakapaheko ā-kawakore

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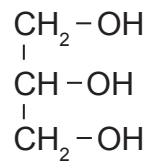
- $$\begin{array}{ccccccc} & & \text{O} & & & & \\ & & || & & & & \\ \text{H}_2\text{N}-\text{CH}-\text{C}-\text{N}-\text{CH}-\text{COOH} \\ | & & & | & & | & \\ \text{CH}_3 & & & \text{H} & & \text{CH}_2\text{OH} & \end{array}$$

- a description of a hydrolysis reaction
- reagents and conditions required
- structural formulae of the products from BOTH acidic and basic hydrolysis.

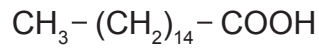
Products from acidic hydrolysis	Products from basic hydrolysis

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- (c) (i) Tātuhia te ture tātai hanganga o te hākawa-toru nonireka (triglyceride) ka puta i te nonireka me te waikawa ngako, te waikawa hinu (palmitic acid) e whakaaturia ana i raro.



nonireka



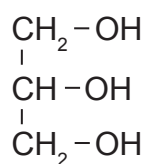
waikawa hinu (palmitic acid)

- (ii) Whakamāramahia te take he tauhohenga tōtā tēnei.

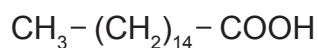
- (iii) Ka taea e te hākawa-toru nonireka kua puta i (c)(i) te whakapaheko ā-wai mā te whakawera i raro i te rerenga whakamuri, i runga i ngā āhuatanga waikawa, kawakore rānei.

Tuhia ngā painga o te whakawera i raro i te rerenga whakamuri ina whakapaheko ā-wai i tētahi hākawa-toru nonireka.

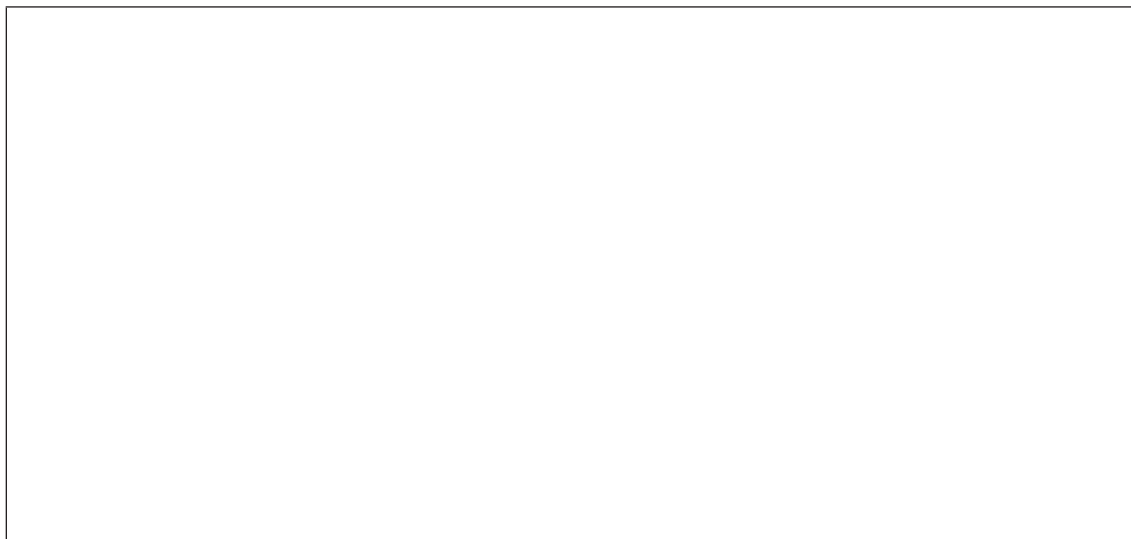
- (c) (i) Draw the structural formula of the triglyceride that would be formed from glycerol and the fatty acid, palmitic acid, provided below.



glycerol



palmitic acid



- (ii) Explain why this is a condensation reaction.

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- (iii) The triglyceride formed in (c)(i) can be hydrolysed by heating under reflux in either acidic or basic conditions.

Outline the advantages of heating under reflux when hydrolysing a triglyceride.

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He whārangi anō ki te hiahiatia.  
Tuhia te (ngā) tau tūmahi mēnā e tika ana.

TAU TŪMAHI

MĀ TE  
KAIMĀKA  
ANAKE

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

QUESTION  
NUMBER

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He whārangī anō ki te hiahiatia.  
Tuhia te (ngā) tau tūmahi mēnā e tika ana.

TAU TŪMAHI

MĀ TE  
KAIMĀKA  
ANAKE

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

QUESTION  
NUMBER

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*English translation of the wording on the front cover*

**Level 3 Chemistry 2020**

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

2.00 p.m. Friday 27 November 2020  
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 is 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 and clearly number the question.

Check that this booklet has pages 2–23 in the correct order and that none of these pages is blank.

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