91391M

913915

NZQA

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

Te Mātauranga Matū, Kaupae 3, 2019

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

2.00i te ahiahi Rāpare 14 Whiringa-ā-rangi 2019
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 KATOA kei roto i tēnei pukapuka.

He taka pūmotu kua whakaritea ki te Puka Rauemi L3-CHEMMR.

Mēnā ka hiahia whārangi atu anō koe mō ō tuhinga, 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 2–21 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.

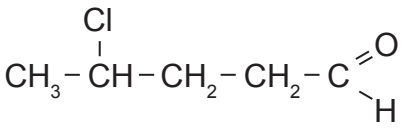
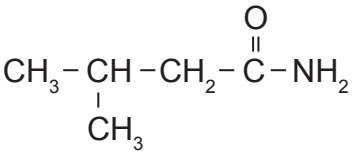
TAPEKE

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATAHI

MĀ TE KAIMĀKA ANAKE

(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.

Ture tātai hanganga	Ingoa (nahanaha) IUPAC
	
	Ohākawa ewaro
	

(ii) Ka taea te waihā pōwaro, CH_3-CH_2-CHO, te hanga mai i te ōhikitanga o tētahi waiwaihā tuatahi.

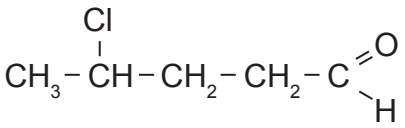
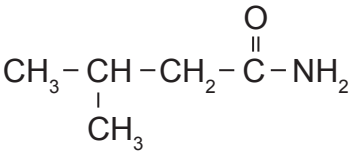
Tātuhia te ture tātai hanganga o te waiwaihā tuatahi, ka whakamārama i te take he aha e hiahiatia ai te iheunga kia taea ai te hua hāparo-tahi i roto i te tukanga ōhikitanga.

Waiwaihā tuatahi:

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.

Structural formula	IUPAC (systematic) name
	
	Ethyl hexanoate
	

(ii) Propanal, CH_3-CH_2-CHO, can be formed from the oxidation of a primary alcohol.

Draw the structural formula of the primary alcohol, and explain why distillation is required to obtain the aldehyde product during the oxidation process.

Primary alcohol:

(b) Whakaahua me te whakamārama i tētahi whakamātautau matū hei wehewehe i ngā takirua i raro nei o ngā rāpoi ngota whaiwaro.

MĀ TE KAIMĀKA ANAKE

Me whakauru ki tō tuhinga:

- ngā whakahohe me ngā āhuatanga e hiahiatia ana
- ngā kitenga
- te momo tauhohenga i whakamahia hei wehewehe i ia takirua
- ngā ture tātai hanganga o ngā hua whaiwaro.

(i) waihā-1-pōwaro me te waiwaro rua pōwaro

(ii) hāparo-tahi pūwaro me te waihā-1-pūwaro

(iii) waikawa ewaro waihā-kore pūhaumāota (ethanoyl chloride) me te pēhākawa ewaro (ethyl pentanoate)

ASSESSOR'S USE ONLY

(b) Describe and explain a chemical test to distinguish the following pairs of organic molecules.

Your answer should include:

- reagents and conditions required
- observations
- the reaction type used to distinguish each pair
- structural formulae of any organic products.

(i) propan-1-ol and propene

(ii) butanal and butan-1-ol

(iii) ethanoyl chloride and ethyl pentanoate

(c) Ko **W**, tē mōhiotia, he rāpoi ngota whaiwaro mekameka-torotika me te tātai rāpoi ngota $C_4H_6OCl_2$. E whakaatu ana a **W**, tē mōhiotia, i ngā āhuatanga me ngā tauhohenga e whai ake:

- ehara i te poinanaha whakaata (enantiomer)
- he whakaputa i ngā au mamaoa me te wai
- he tautohe ki te haukini nui rawa kia puta ai te hua **X**. Ka huri te hua **X** i te tohu waikawa mākū ki te kikorangi.

Ka whakapāheko ā-waikawatia a **X** kia puta ai te hua **Y**. Ka puta ngā mirumiru ina hohe te hua **Y** ki te mehanga konutai pākawa waro.

Tātuhia ngā ture tātai hanganga mō ngā rāpoi ngota whaiwaro **W**, **X** me **Y** ki te tūtohi i raro.

Rāpoi ngota whaiwaro	**Ture tātai hanganga**
W	
X	
Y	

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(c) Unknown **W** is a straight-chain organic molecule with the molecular formula $C_4H_6OCl_2$. Unknown **W** shows the following properties and reactions:

- does not exist as enantiomers (optical isomers)
- produces steamy fumes with water
- reacts with an excess of ammonia to form product **X**. Product **X** turns damp litmus blue.

Product **X** undergoes acidic hydrolysis to produce product **Y**. Bubbles are released when product **Y** reacts with sodium carbonate solution.

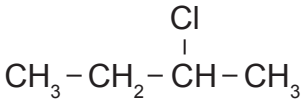
Draw the structural formulae for the organic molecules **W**, **X**, and **Y** in the table below.

Organic molecule	Structural formula
W	
X	
Y	

TŪMAHI TUARUA

MĀ TE KAIMĀKA ANAKE

(a) Ka taea te 2-pūwaro pūhaumāota te noho hei poinanaha whakaata (enantiomer).



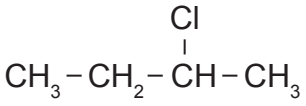
(i) Tātuhia ngā poinanaha whakaata o te 2-pūwaro pūhaumāota ki te tapawhā i raro nei.

(ii) Whakamāramahia ka pēhea te wehewehe i ngā poinanaha whakaata e rua o te 2-pūwaro pūhaumāota.

QUESTION TWO

ASSESSOR'S USE ONLY

(a) 2-chlorobutane can exist as enantiomers (optical isomers).

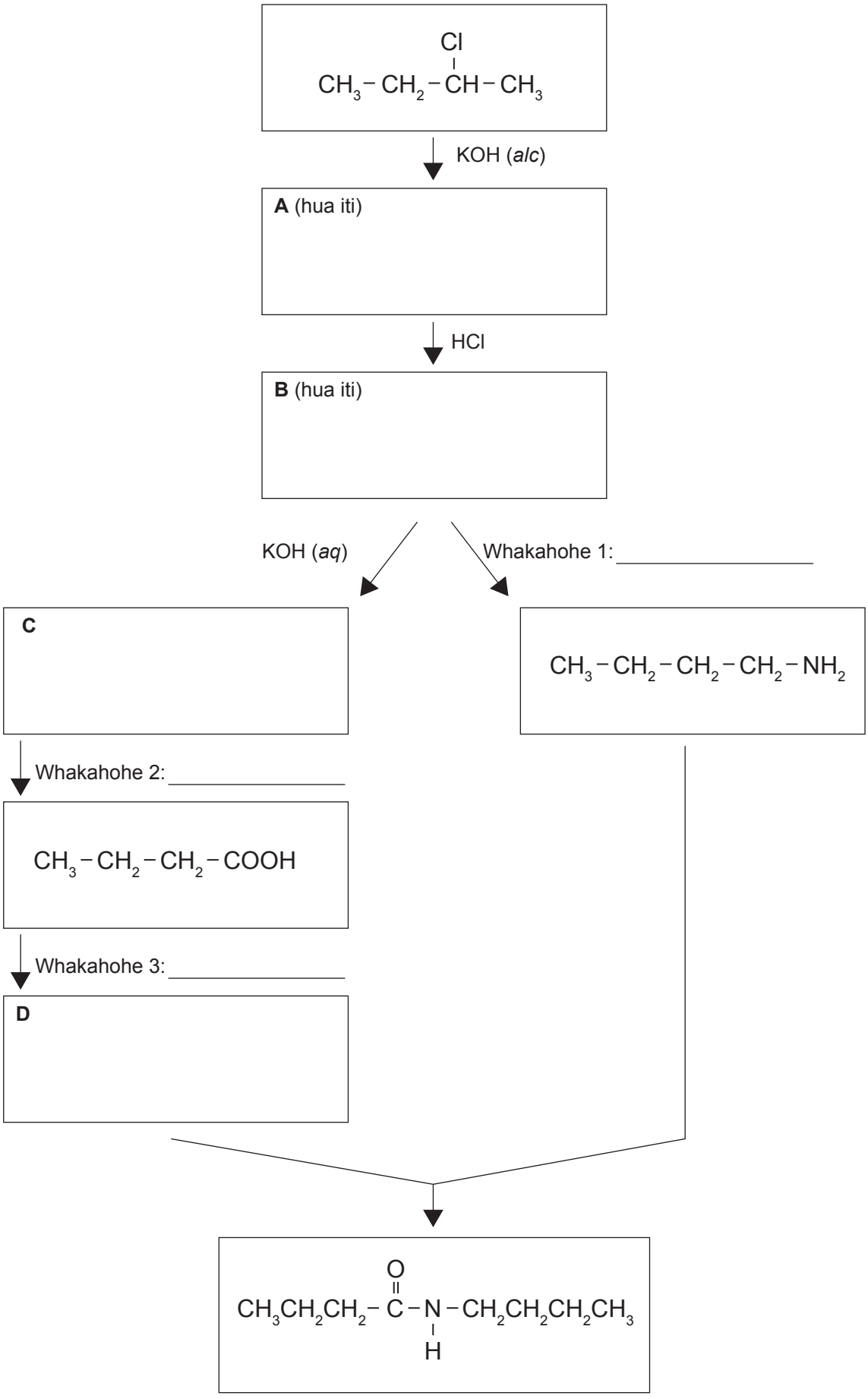


(i) Draw the enantiomers of 2-chlorobutane in the box below.

(ii) Explain how the two enantiomers of 2-chlorobutane could be distinguished.

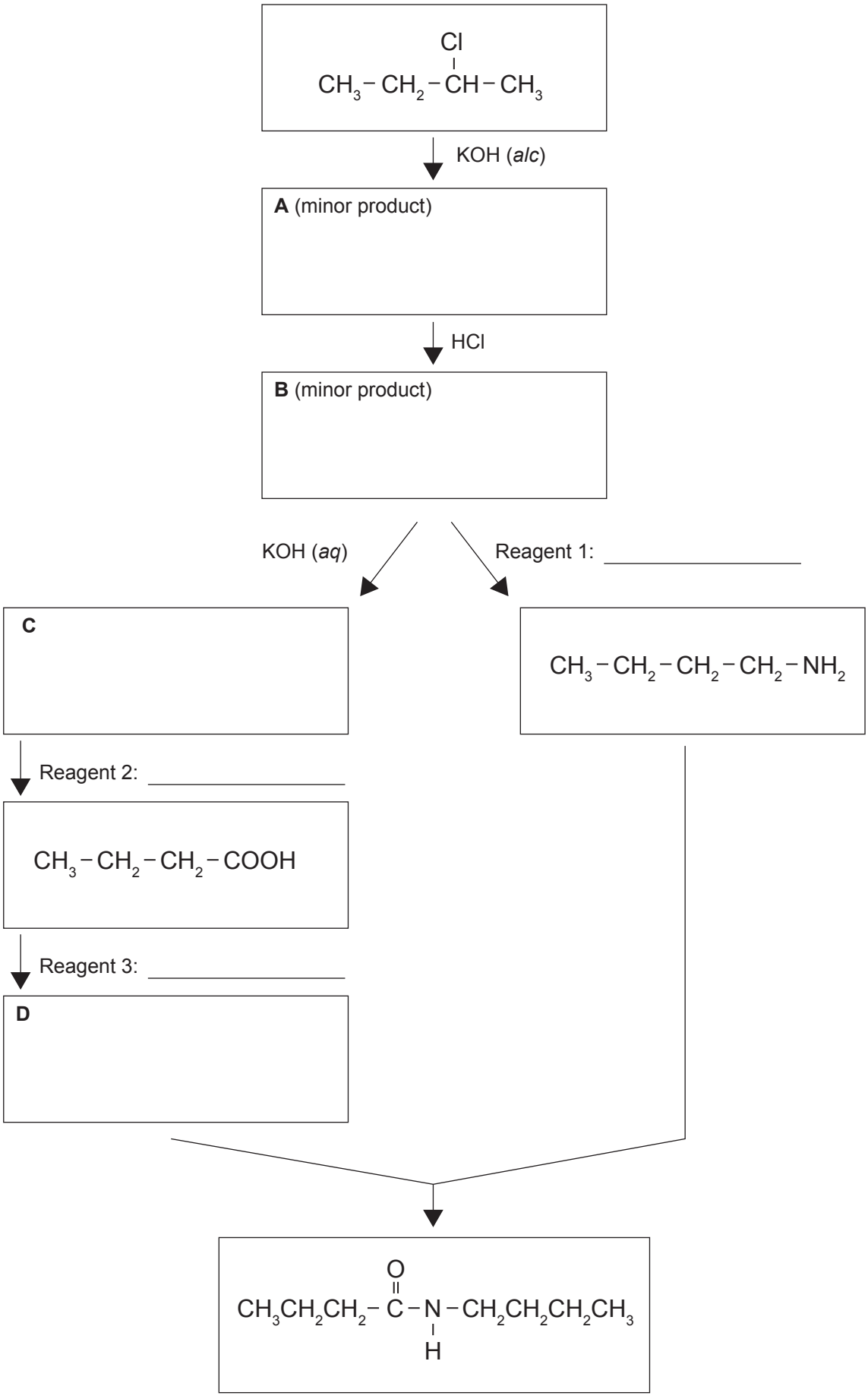
(b) Whakaotia te mahere tauhohe e whai ake mā te tātuhi i ngā ture tātai hanganga mō ngā hua whaiwaro A, B, C me te D, me te tautohu i ngā whakahohe 1, 2 me te 3.

MĀ TE KAIMĀKA ANAKE



ASSESSOR'S USE ONLY

(b) Complete the following reaction scheme by drawing the structural formulae for organic products A, B, C, and D, and identifying reagents 1, 2, and 3.



(c) Ka taea ētahi poinanaha hanganga rerekē mai i te $C_5H_{10}O$.

MĀ TE KAIMĀKA ANAKE

Tātuhia ngā ture tātai hanganga mō ngā poinanaha o te $C_5H_{10}O$ e ū ana ki ngā whakaritenga e whai ake.

(i) Ka puta he whakaata hiriwa i te rāpoi ngota mekameka-torotika ina whakawerahia ki te whakahohe Tollens.

(ii) He rāpoi ngota mekameka-peka kāore e puta he whakaata hiriwa ina whakawerahia ki te whakahohe Tollens.

(iii) He rāpoi ngota porowhita whaiwaro-rima e puta ai ngā au mamaoa ina tauhohea ki te tionira pūhaumāota, $SOCl_2$.

(iv) He waiwaihā tuarua mekameka-torotika e whakakore ana i te tae o te wai pūkane, ā, ka taea te noho hei poinanaha *cis-trans* (āhuahanga) me ngā poinanaha whakaata (enantiomer).

ASSESSOR'S USE ONLY

(c) $C_5H_{10}O$ can exist as a number of different constitutional (structural) isomers.

Draw the structural formulae for the isomers of $C_5H_{10}O$ that meet the following requirements.

(i) Straight-chain molecule that forms a silver mirror when heated with Tollens' reagent.

(ii) Branched-chain molecule that does not form a silver mirror when heated with Tollens' reagent.

(iii) Five-carbon ring cyclic molecule that forms steamy fumes when reacted with thionyl chloride, $SOCl_2$.

(iv) Straight-chain secondary alcohol that decolourises bromine water, and can exist as both *cis-trans* (geometric) isomers and enantiomers (optical isomers).

TŪMAHI TUATORU

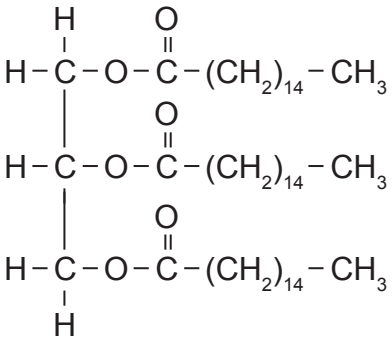
MĀ TE KAIMĀKA ANAKE

(a) Whakamahia ai te koriaku 6,6 ki te mahi pēkehau. Kei raro nei ngā waetahi e whakamahia ana hei mahi i te koriaku 6,6:

(i) Ki te tapawhā i raro, tātuhia he wāhanga o te mekameka waerau koriaku 6,6 hei whakaatu i ngā wae tāruarua e RUA.

(ii) Whakamāramahia te take e kīia ana te koriaku 6,6 he waerau tōtā.

(b) Kitea ai ngā hākawa-toru nonireka (triglyceride) i roto i ngā mōmona me ngā hinu. He tauira kei raro o te hākawa-toru nonireka.



(i) Porohitatia TĒTAHI o ngā rōpū hākawa i roto i te rāpoi ngota hākawa-toru nonireka i runga.

QUESTION THREE

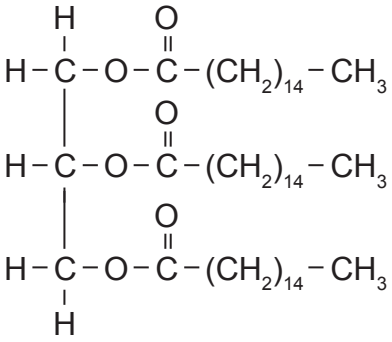
ASSESSOR'S USE ONLY

(a) Nylon 6,6 is used to make airbags. The monomers used to make nylon 6,6 are shown below:

(i) In the box below, draw a section of the nylon 6,6 polymer chain to show TWO repeating units.

(ii) Explain why nylon 6,6 is referred to as a condensation polymer.

(b) Triglycerides are found in fats and oils. Below is an example of a triglyceride.



(i) Put a circle around ONE of the ester groups in the triglyceride molecule shown above.

(ii) Whakatauritea te whakapāheko ā-waikawa me te whakapāheko ā-kawakore o te rāpoi ngota hākawa-toru nonireka e whakaaturia ana kei te whārangi o mua.

MĀ TE KAIMĀKA ANAKE

I tō tuhinga, me whakauru:

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

Ka haere tonu te Tūmahi Tuatoru i te whārangi 18.

ASSESSOR'S USE ONLY

(ii) Compare and contrast the acidic and basic hydrolysis of the triglyceride molecule shown on the previous page.

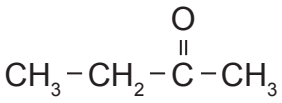
In your answer, you should include:

- an explanation of the hydrolysis reaction
- structural formulae of the products formed from both acidic and basic hydrolysis
- reagents and conditions required.

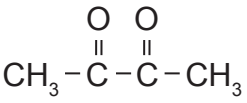
Question Three continues on page 19.

(c) Hangaia he mahere tauhohe hei whakawhiti i te hāparo-rua pūwaro (butanone) ki te hāparo-rua (huarua) 2,3 pūwaro (butan-2,3-dione).

MĀ TE KAIMĀKA ANAKE



hāparo-rua pūwaro



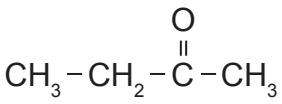
hāparo-rua (huarua)
2,3 pūwaro (butan-2,3-dione)

Mō ia upane me whakauru:

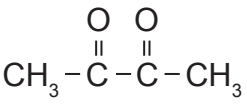
- ngā whakahohe me ngā āhuatanga
- te ture tātai hanganga o te hua whaiwaro i muri i ia upane.

(c) Devise a reaction scheme to convert butanone into butan-2,3-dione.

ASSESSOR'S USE ONLY



butanone



butan-2,3-dione

For each step include:

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

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

ASSESSOR'S USE ONLY

English translation of the wording on the front cover

Level 3 Chemistry, 2019

91391 Demonstrate understanding of the properties of organic compounds

2.00 p.m. Thursday 14 November 2019
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.

91391M

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 2–21 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.