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, 2017

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

2.00 i te ahiahi Rāapa 15 Whiringa-ā-rangi 2017
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 mō ō tuhinga, whakamahia ngā whārangi wātea kei muri o tēnei pukapuka, ka āta tohu ai i ngā 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.

HOATU TE PUKAPUKA NEI KI TE KAIWHAKAHAERE HEI TE MUTUNGA O TE WHAKAMĀTAUTAU.

TAPEKE

MĀ TE KAIMĀKA ANAKE

TŪMAHI TUATAHI

MĀ TE KAIMĀKA ANAKE

(a) Whakaotia te tūtohi i raro hei tohu i te ingoa IUPAC, te rōpū mahinga, te ture tātai hanganga hoki/rānei mō ngā pūhui whaiwaro e **whā anake ngā ngota waro**. Kua oti te rārangi tuatahi.

Rōpū mahinga	**Ture tātai hanganga**	**Ingoa (nahanaha) IUPAC**
Waiwaro rua	$CH_3CH_2CH=CH_2$	waiwaro rua-1-pūwaro
		1-amine-2-mewaro pōwaro
Āhiri pūhaumāota (Acyl chloride)		
		mehākawa pōwaro
	$CH_3CH_2-\overset{\overset{O}{\|\|}}{C}-CH_3$	
Hāparo-tahi		
Pūhaukini		pūhaukini pūwaro

QUESTION ONE

ASSESSOR'S USE ONLY

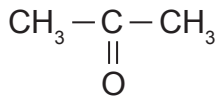
(a) Complete the table below to indicate the IUPAC name, functional group, and/or the structural formula for organic compounds that contain **only four carbon atoms**. The first row has been completed for you.

Functional group	Structural formula	IUPAC (systematic) name
Alkene	$CH_3CH_2CH=CH_2$	but-1-ene
		2-methylpropan-1-amine
Acyl chloride		
		propyl methanoate
	$CH_3CH_2-\overset{\overset{O}{\|\|}}{C}-CH_3$	
Aldehyde		
Amide		butanamide

(b) Whakaotia te mahere tauhohe e whai ake mā te tātuhi i ngā ture tātai hanganga o ngā pūhui waro e rua o **A** me **B**, me ngā hua matua, hua iti hoki o **C** me **D**.

MĀ TE KAIMĀKA ANAKE

Me tautohu ngā whakahohe e rua 1 me 2, ka tohu i te momo tauhohenga ka puta i ia kaupae.



Hāparo-rua pōwaro

Te momo tauhohenga: _____ Whakahohe 1: _____

A.

Te momo tauhohenga: _____ Whakahohe 2: _____

B.

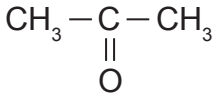
Te momo tauhohenga: _____ Whakahohe 3: **HCl**

C. Hua matua	**D**. Hua iti

ASSESSOR'S USE ONLY

(b) Complete the following reaction scheme by drawing the structural formulae of both organic compounds **A** and **B**, as well as the major and minor products **C** and **D**.

Identify both reagents 1 and 2, and indicate the type of reaction occurring at each step.



Propanone

Type of reaction: _____ Reagent 1: _____

A.

Type of reaction: _____ Reagent 2: _____

B.

Type of reaction: _____ Reagent 3: **HCl**

C. Major product	**D**. Minor product

(c) Ka taea e ētahi pūhui waro te noho hei poinanaha whakaata (poinanaha ōmata).

Ko tētahi tauira ko tētahi waiwaihā tuarua whai tātai rāpoi ngota C_4H_9OH.

MĀ TE KAIMĀKA ANAKE

(i) Tātuhia ngā poinanaha whakaata o te C_4H_9OH ki te pouaka i raro nei.

(ii) Whakamāramatia te tikanga o ngā kupu poinanaha whakaata (poinanaha ōmata).

I tō tuhinga, me:

- tautohu te whakaritenga hanganga mō tētahi rāpoi ngota, pēnei i te C_4H_9OH, hei poinanaha whakaata
- whakamārama me pēhea te wehewehe i ngā poinanaha whakaata tētahi i tētahi.

ASSESSOR'S USE ONLY

(c) Some organic compounds can exist as enantiomers (optical isomers).

An example is a secondary alcohol with the molecular formula C_4H_9OH.

(i) Draw the enantiomers of C_4H_9OH in the box below.

(ii) Explain what is meant by the term enantiomers (optical isomers).

In your answer, you should:

- identify the structural requirement for a molecule, such as C_4H_9OH, to exist as enantiomers
- explain how enantiomers can be distinguished from each other.

TŪMAHI TUARUA

MĀ TE KAIMĀKA ANAKE

(a) He poinanaha hanganga mekameka-tōtika te pūhui **P** me te pūhui **Q** whai tātai rāpoi ngota $C_5H_{12}O$. Ka taea e te pūhui **P** te waihanga poinanaha whakaata, engari kāore e taea e **Q**.

Ina whakahohea ki te waikawa pungatara kukū, e rua ngā hua ka puta i te pūhui **P,** ngā pūhui **R** me **S**; kotahi anake te hua ka puta i te pūhui **Q**, arā, ko te pūhui **S**.

Ina whakahohea te pūhui **Q** ki te *Whakahohe 1*, ka puta ko te waiwaro tahi haumāota, arā, ko te pūhui **T**.

Ka tauhohe te pūhui **T** ki te NH_3 kukū kia puta ko te pūhui **U**.

Ka taea anō te pūhui **Q** te ōhiki kia puta ai te pūhui **V**, e whero ai te pepa tohu waikawa kikorangi.

Ka taea anō te pūhui **V** te whakahohe ki te pūhui **Q** me te *Whakahohe 2*, kia puta ai he wē āngi[1], arā, ko te pūhui **W**.

Whakamahia ngā mōhiohio i runga hei tautohu i ngā pūhui **P** ki te **W**, me ngā *whakahohe* **1** me te **2**.

Kua whakaritea he wāhi i te pouaka i raro mō te whakamahere/tātaitanga.

[1] kakara

Whakaotia ngā tūtohi e whai ake mā te whakamahi i ngā mōhiohio i kitea i te whārangi 8.

MĀ TE KAIMĀKA ANAKE

Pūhui	Hanganga
P	
Q	
R	
S	
T	
U	
V	
W	

Whakahohe 1	
Whakahohe 2	

QUESTION TWO

ASSESSOR'S USE ONLY

(a) Compound **P** and compound **Q** are straight-chain constitutional (structural) isomers with the molecular formula $C_5H_{12}O$. Compound **P** can form optical isomers, whereas compound **Q** cannot.

When reacted with concentrated sulfuric acid, compound **P** forms two products, compounds **R** and **S**; compound **Q** forms only one product, compound **S**.

When compound **Q** is reacted with *Reagent 1*, it forms a chloroalkane, compound **T**.

Compound **T** reacts with concentrated NH_3 to form compound **U**.

Compound **Q** can also be oxidised to form compound **V**, which will turn moist blue litmus paper red.

Compound **V** can also be reacted with compound **Q** and *Reagent 2*, to form a sweet-smelling liquid, compound **W**.

Use the information above to identify compounds **P** to **W**, and *reagents* **1** and **2**.

Space for planning/working is provided in the box below.

Complete the following tables using the information found on page 10.

ASSESSOR'S USE ONLY

Compound	Structure
P	
Q	
R	
S	
T	
U	
V	
W	

Reagent 1	
Reagent 2	

MĀ TE KAIMĀKA ANAKE

(b) (i) Ka puta te hāparo-tahi pōwaro, te waikawa pōwaro rānei mā te tāpiri i tētahi mehanga konurehu pākawa konukita-rua kua whakawaikawatia ki te waihā-1-pōwaro.

Whakamāramahia te tukanga taiwhanga ka whakamahia hei whakawhiti i te waihā-1-pōwaro ki te **hāparo-tahi pōwaro**.

I tō tuhinga, me:

- whakarārangi mai i te tukanga mō te whakawhiti, me te whakaahua i ngā huringa tae ka tūhonoa ki ngā momo kei roto
- tuhi i te momo tauhohenga kei te puta
- whakamārama he pēhea te whakarite a te tukanga kia kohia ko te **hāporo-tahi pōwaro** anake.

(ii) Whakamāramahia mai me pēhea te whakamahi i te mehanga a Benedict hei wehewehe i te hāparo-rua pōwaro me te hāparo-tahi pōwaro.

I tō tuhinga, me whakauru:

- ko ngā kitenga ka puta e tūhono ana ki ngā pūhui whaiwaro kei roto
- te momo tauhohenga kei te puta
- ngā whārite hāngai e whakaatu ana i ngā matū hohe whaiwaro me ngā hua kei raro.

ASSESSOR'S USE ONLY

(b) (i) Adding an acidified potassium dichromate solution to propan-1-ol can produce either propanal or propanoic acid.

Explain the laboratory procedure used to convert propan-1-ol to **propanal**.

In your answer, you should:

- outline the procedure for the conversion, and describe any colour changes linked to the species involved
- state the type of reaction occurring
- explain how the procedure ensures only **propanal** is collected.

(ii) Explain how Benedict's solution can be used to distinguish between propanone and propanal.

In your answer, you should include:

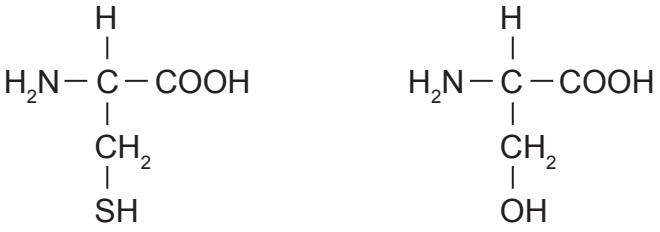
- any observations made linked to the organic compounds involved
- the type of reaction occurring
- relevant equations showing any organic reactants and products involved.

TŪMAHI TUATORU

MĀ TE KAIMĀKA ANAKE

He rāpoi ngota ngā pētini ka puta ina paheko ai ngā waikawa amino.

E whakaatu ana ngā hanganga e whai ake i ngā waikawa amino hītina (cysteine) me te herina (serine).



hītina

herina

(a) (i) Ki ngā pouaka i raro, whakaaturia kia rua ngā pētini-rua ka taea mā te paheko i ngā waikawa amino e rua e whakaaturia ana i runga ake.

Pētini-rua 1:
Pētini-rua 2:

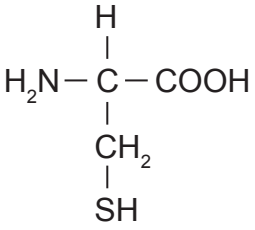
(ii) Porowhitatia te rōpū mahinga pūhaukini i runga i TĒTAHI o ngā pētini-rua kua tuhia e koe i te wāhanga (i).

QUESTION THREE

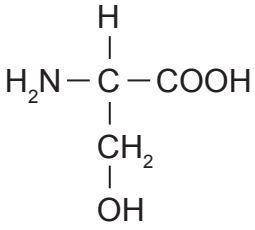
ASSESSOR'S USE ONLY

Peptides are molecules that form when amino acids combine.

The following structures show the amino acids cysteine and serine.



cysteine



serine

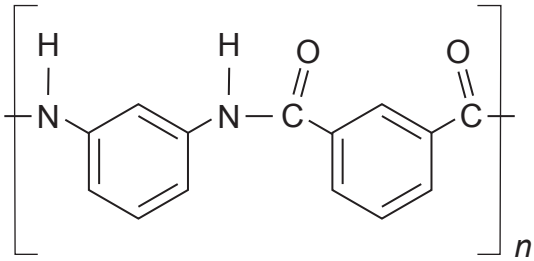
(a) (i) In the boxes below, show two possible dipeptides that can be formed by combining the two amino acids shown above.

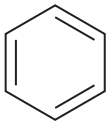
Dipeptide 1:
Dipeptide 2:

(ii) Circle the amide functional group on ONE of the dipeptides drawn in part (i).

(b) He waerau te Nomex® ka whakamahia i roto i ngā kākahu o ngā kaipatu ahi. Ka hangaia mai te Nomex® ki ngā waetahi rerekē e rua ka honoa tahitia kia puta ai te mekameka waerau.

E whakaaturia ana i raro ko tētahi wāhanga iti o te hanganga o te Nomex®.



Kia mōhio:  he rīngi penehīni, ā, e kore mō te huri ina hono tahi ai ngā waetahi kia puta ai te waerau.

Whakamāramahia te hanganga o te waerau, Nomex®.

I tō tuhinga me whakauru koe:

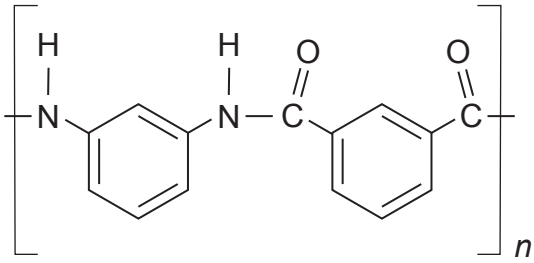
- te ingoa o te rōpū mahinga e honohono ana i ngā waetahi
- he tātuhinga o ngā waetahi e rua
- he whakarōpūtanga o te momo waerau ka puta, me tētahi whakamāramatanga hei parahau i tō kōwhiringa.

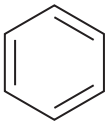
MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(b) Nomex® is a polymer used in firefighters' suits. Nomex® is made up of two different monomers bonded together to form the polymer chain.

A small portion of the structure of Nomex® is shown below.



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

Explain the structure of the polymer, Nomex®.

In your answer, you should include:

- the name of the functional group linking the monomers
- a drawing of both monomers
- a classification of the type of polymer formed, with an explanation to justify your choice.

(c) Ka taea ngā waerau pērā i te Nomex® te whakapāheko ā-wai mā te waikawa, pāpāhua waiwai rānei.

MĀ TE KAIMĀKA ANAKE

Whakaaturia ngā hua o te whakapāheko ā-wai o te Nomex® mā te whakamahi i te:

(i) waikawa waiwai

(ii) pāpāhua waiwai.

ASSESSOR'S USE ONLY

(c) Polymers such as Nomex® can be hydrolysed by either aqueous acid or base.

Show the products of the hydrolysis of Nomex® using:

(i) aqueous acid

(ii) aqueous base.

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, 2017

91391 Demonstrate understanding of the properties of organic compounds

2.00 p.m. Wednesday 15 November 2017
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 on the Resource Sheet L3–CHEMR.

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.