**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, 2018

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

2.00i te ahiahi Rāpare 15 Whiringa-ā-rangi 2018
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 2–19 kei roto i tēnei pukapuka, ā, 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.**

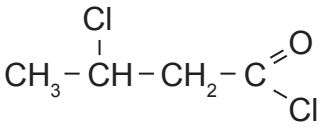
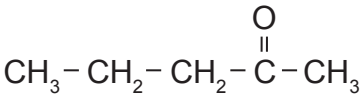
**TAPEKE**

**MĀ TE KAIMĀKA ANAKE**

## TŪMAHI TUATAHI

MĀ TE KAIMĀKA ANAKE

(a) 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 |
|---|---|
|  | |
|  | |
| | 4-mewaro hāparo-tahi owaro |
| | pūhaukini pōwaro (propanamide) |

(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 e toru ko te:

hāparo-tahi pēwaro $CH_3CH_2CH_2CH_2CHO$

waihā-1-pēwaro $CH_3CH_2CH_2CH_2CH_2OH$

waikawa pēwaro waihā-kore pūhaumāota $CH_3CH_2CH_2CH_2COCl$

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

- wai
- whakahohe a Tollens
- konurehu konukita-rua i whakawaikawatia, $H^+/K_2Cr_2O_7$.

Me whakauru ki tō hātepe ko:

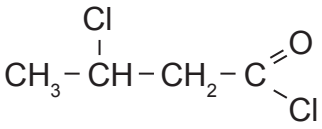
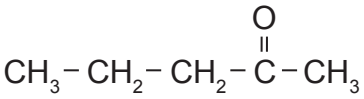
- ngā mātakinga e hono ana ki ngā momo kei roto
- te momo tauhohenga kei te puta
- ngā ture tātai hanganga o ngā hua whaiwaro.

MĀ TE KAIMĀKA ANAKE

## QUESTION ONE

ASSESSOR'S USE ONLY

(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 |
|---|---|
|  | |
|  | |
| | 4-methylhexanal |
| | propanamide |

(b) Three bottles, each containing a different colourless liquid, have been incorrectly labelled. The three colourless liquids are known to be:

| | |
|---|---|
| pentanal | $CH_3CH_2CH_2CH_2CHO$ |
| pentan-1-ol | $CH_3CH_2CH_2CH_2CH_2OH$ |
| pentanoyl chloride | $CH_3CH_2CH_2CH_2COCl$ |

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

- water
- Tollens' reagent
- acidified potassium dichromate, $H^+/K_2Cr_2O_7$.

Your procedure should include:

- observations linked to the species involved
- the type of reaction occurring
- structural formulae of any organic products.

ASSESSOR'S USE ONLY

(c) He $C_4H_8O_3$ te tātai rāpoi ngota o te X tē mōhiotia, ā, ka puta ngā tauhohenga e whai ake:

- Ka tauhohe a X ki te mehanga konutai pākawa waro hei whakaputa i te hauhā.
- Ina whakaweratia a X ki te konurehu konukita-rua i whakawaikawatia, ka huri te tae mai i te karaka ki te kākāriki, engari kāore te hua e tauhohe ki te mehanga Benedict.
- He tauhohenga tangohanga ka puta i a X me te waikawa pungatara kukū kia puta ai ngā hua whaiwaro e rua.

E ai ki ngā mōhiohio i runga ake, tātuhia te tātai hanganga o X Tē Mōhiotia.

Parahautia tō tātai hanganga o X, me:

- ngā ture tātai hanganga o ngā hua whaiwaro
- tētahi whakamāramatanga o ngā hua nui, iti hoki pea ka puta.

| Tātai hanganga mō X Tē Mōhiotia: |
| --- |

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(c) Unknown X has the molecular formula $C_4H_8O_3$ and undergoes the following reactions:

- It reacts with sodium carbonate solution to release carbon dioxide gas.
- When X is heated with acidified potassium dichromate, the colour changes from orange to green, but the product does not react with Benedict's solution.
- X undergoes an elimination reaction with concentrated sulfuric acid to produce two organic products.

Based on the information above, draw the structural formula of Unknown X.

Justify your structural formula of X, including:

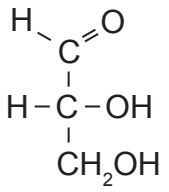
- structural formulae of any organic products
- an explanation of any major and minor products.

Structural formula for Unknown X:

## TŪMAHI TUARUA

MĀ TE KAIMĀKA ANAKE

(a) E whakaaturia ana te tātai hanganga o te 2,3-hāparo-tahi pōwaro waihā-rua, ko tētahi ingoa anō ko te hāparo-tahi nonireka (glyceraldehyde), i raro.




Ka taea e te hāparo-tahi nonireka te noho hei poinanaha whakaata (poinanaha ōmata).

(i) Tātuhia ngā poinanaha whakaata o te hāparo-tahi nonireka ki te tapawhā i raro nei.

(ii) Whakamāramahia he aha i taea ai e te hāparo-tahi nonireka te noho hei poinanaha whakaata.

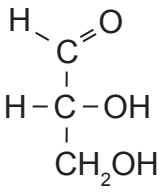
(iii) Me pēhea te wehewehe i ngā poinanaha whakaata e rua o te hāparo-tahi nonireka?

Whakamāramatia tō tuhinga.

## QUESTION TWO

ASSESSOR'S USE ONLY

(a) The structural formula of 2,3-dihydroxypropanal, more commonly known as glyceraldehyde, is shown below.




Glyceraldehyde can exist as enantiomers (optical isomers).

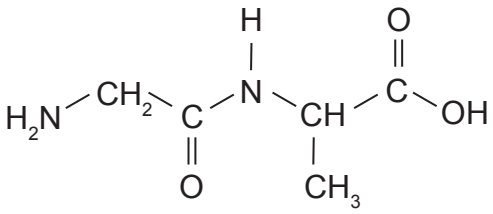
(i) Draw the enantiomers of glyceraldehyde in the box below.

(ii) Explain why glyceraldehyde can exist as enantiomers.

(iii) How could the two enantiomers of glyceraldehyde be distinguished?

Explain your answer.

(b) Hangaia ai ngā pētini-rua (dipeptide) mai i ngā waikawa amino e rua e honoa ana e tētahi hononga pūhaukini (pētini). Ka mahia te pētini-rua e whakaaturia ana i raro mai i te kairīni (glycine) me te aranina (alanine):




MĀ TE KAIMĀKA ANAKE

(i) Porowhitatia te hononga pūhaukini (pētini).

(ii) Whakatauritea ngā whakapāheko ā-wai waikawa me te kawakore o te pētini-rua o runga ake.

Me whakauru ki tō tuhinga:

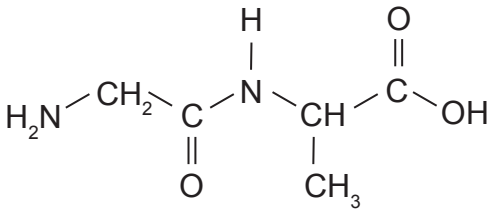
- tētahi whakamāramatanga o te tauhohenga whakapāheko ā-wai
- ngā tātai hanganga o ngā hua ka puta mai i te whakapāheko ā-wai waikawa me te kawakore o te pētini-rua, ki ngā tapawhā e rua kua tukuna.

Whakapāheko ā-wai waikawa:

Whakapāheko ā-wai kawakore:

ASSESSOR'S USE ONLY

(b) Dipeptides are made from two amino acids joined by an amide (peptide) bond. The dipeptide shown below is made from glycine and alanine:




(i) Circle the amide (peptide) bond.

(ii) Compare and contrast the acidic and basic hydrolysis of the above dipeptide.

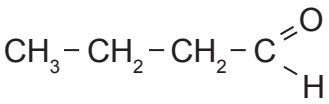
Your answer should include:

- an explanation of the hydrolysis reaction
- structural formulae of the products formed when the dipeptide undergoes acidic and basic hydrolysis, in the two boxes provided.

Acidic hydrolysis:

Basic hydrolysis:

(c) Ko te tātai hanganga o te hāporo-tahi pūwaro he:



Hangaia he mahere tauhohe hei tahuri i te hāporo-tahi pūwaro ki te hāporo-rua pūwaro.

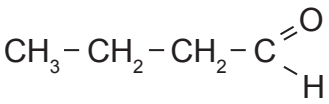
Mō ia upane me whakauru:

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

MĀ TE KAIMĀKA ANAKE

ASSESSOR'S USE ONLY

(c) The structural formula of butanal is:



Devise a reaction scheme to convert butanal into butanone.

For each step include:

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

## TŪMAHI TUATORU

MĀ TE KAIMĀKA ANAKE

Ka taea te waikawa kūhuka te whakamahi hei mahi i te waikawa kūhuka-rau (PGA), he hākawa-rau e whakamahia ana hei mahi i ngā tuitui whakarewa. E whakaaturia ana te hanganga o te waikawa kūhuka i raro nei.

$HO - CH_2 - COOH$

(a) (i) Ki te tapawhā i raro, tātuhia he wāhanga o te mekameka waerau PGA hei whakaatu i ngā wae tāruarua e TORU.

(ii) Tautohua, whakamāramahia hoki te momo tauhohenga kei te puta i te hanganga o te PGA.

(b) He maha ngā tauhohenga kōtui whaiwaro e whakarewahia ana i raro i te rerenga whakamuri (reflux).

(i) Ki te tapawhā i raro, tātuhia te tātai hanganga me te ingoa o te hākawa ka puta mai i te whakawera i te waihā ewaro me te waikawa pūwaro i raro i te rerenga whakamuri i roto i te waikawa pungatara kukū.

$CH_3CH_2OH$
waihā ewaro

$CH_3CH_2CH_2COOH$
waikawa pūwaro

Ingoa: _____

## QUESTION THREE

ASSESSOR'S USE ONLY

Glycolic acid can be used to make polyglycolic acid (PGA), a polyester used to make dissolvable stitches. The structure of glycolic acid is shown below:

$HO - CH_2 - COOH$

(a) (i) In the box below, draw a section of the PGA polymer chain to show THREE repeating units.

(ii) Identify and explain the type of reaction occurring in the formation of PGA.

(b) Many organic synthesis reactions are heated under reflux.

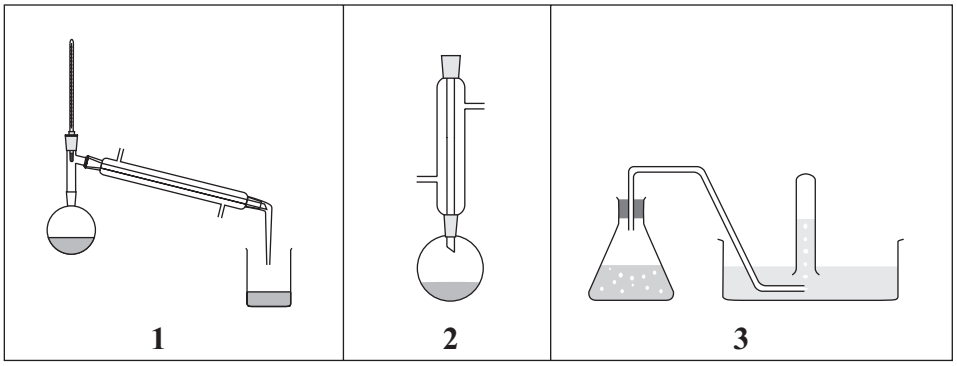
(i) In the box below, draw the structural formula and name the ester formed from heating ethanol and butanoic acid under reflux in the presence of concentrated sulfuric acid.

$CH_3CH_2OH$
ethanol

$CH_3CH_2CH_2COOH$
butanoic acid

Name: _____

(ii) Mai i ngā hoahoa i raro, tuhia te tau o te taputapu ka whakamahia mō te whakawera i raro i te rerenga whakamuri.

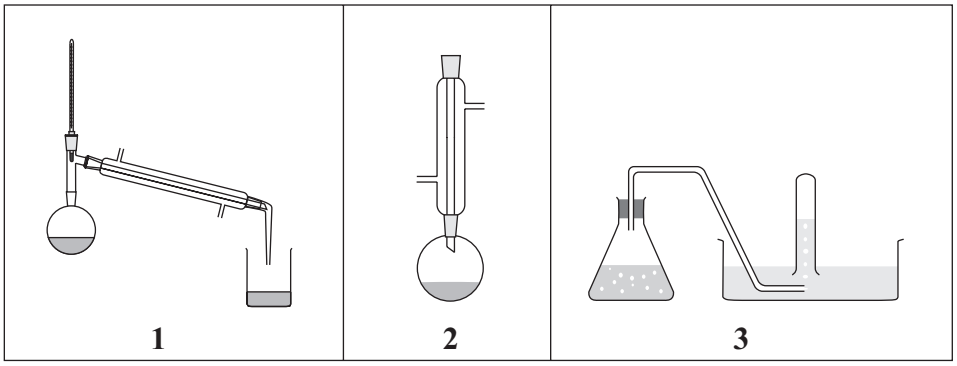



(iii) Tuhia ngā painga o te whakawera i raro i te rerenga whakamuri mō te whakareri i te hākawa i te wāhanga (i).

(iv) Mai i ngā hoahoa i runga, tuhia te tau o te taputapu ka whakamārama i te tukanga ka taea te whakamahi hei horoi (wehe) i te hākawa i te wāhanga (i) mai i te ranunga tauhohenga.

ASSESSOR'S USE ONLY

(ii) From the diagrams below, give the number of the apparatus used for heating under reflux.




(iii) Outline the advantages of heating under reflux in the preparation of the ester in part (i).

(iv) From the diagrams above, give the number of the apparatus and explain the process that could be used to purify (separate) the ester in part (i) from the reaction mixture.

**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, 2018

## 91391 Demonstrate understanding of the properties of organic compounds

2.00 p.m. Thursday 15 November 2018
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–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 2–19 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.**