

91391



NEW ZEALAND QUALIFICATIONS AUTHORITY  
MANA TOHU MĀTAURANGA O AOTEAROA

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SUPERVISOR'S USE ONLY

# Level 3 Chemistry, 2013

## 91391 Demonstrate understanding of the properties of organic compounds

2.00 pm Tuesday 19 November 2013  
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.

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 space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–11 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.**

TOTAL

ASSESSOR'S USE ONLY

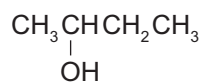
You are advised to spend 60 minutes answering the questions in this booklet.

### QUESTION ONE

- (a) Complete the table below by giving the IUPAC systematic name or the structural formula for each compound.

Structural formula	IUPAC systematic name
$\text{HO} - \text{CH}_2 - \text{CH}_2 - \overset{\text{O}}{\parallel}{\text{C}} - \text{H}$	
	propanamide
$\begin{array}{ccccccc} \text{CH}_3 & - & \text{C} & - & \text{CH}_2 & - & \text{CH} & - & \text{CH}_3 \\ & & \parallel & & & &   & & \\ & & \text{O} & & & & \text{CH}_3 & & \end{array}$	

- (b) The alcohol below can exist as two enantiomers (optical isomers).



- (i) Draw three-dimensional structures for the two enantiomers.

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- (ii) Link the structure of enantiomers to a physical property that can be used to distinguish them from non-optically active molecules.

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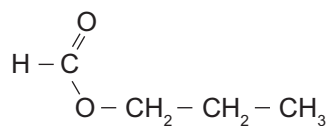
- (c) Draw the structural formulae of three different isomers of  $\text{HO}-\text{CH}_2-\text{CH}_2-\text{C}\begin{matrix} \text{O} \\ // \\ \text{H} \end{matrix}$ , which show the following properties:
- Isomer 1 turns moist blue litmus paper red.
  - Isomer 2 is an ester.
  - Isomer 3 is a ketone.

Property	Structural formula
turns moist blue litmus paper red	
is an ester	
is a ketone	

(d) Give the structures and names of the products of the reactions below.

These reactions are carried out by heating in either:

- dilute hydrochloric acid solution, or
- dilute sodium hydroxide solution.



dilute hydrochloric  
acid solution

dilute sodium  
hydroxide solution

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Compare and contrast the reactions above.

In your answer, you should include the type of reaction(s) taking place.

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## QUESTION TWO

ASSESSOR'S  
USE ONLY

(a) For the following conversions, identify the reagent required, and state the type of reaction occurring.

(i) Pentan-2-one is converted to pentan-2-ol.

Reagent required: \_\_\_\_\_

Type of reaction: \_\_\_\_\_

(ii) Butan-2-ol is converted to a mixture of but-1-ene and but-2-ene.

Reagent required: \_\_\_\_\_

Type of reaction: \_\_\_\_\_

(iii) Discuss the reaction occurring in (ii) above, with reference to the structures of the organic reactant and products.

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- (b) Discuss the laboratory procedures used to convert butan-1-ol into butanal, and butan-1-ol into butanoic acid.

In each discussion, you should:

- outline the process for each conversion
- state and justify the type of reaction occurring
- identify the reagents used, and explain any observations made.

Butan-1-ol to butanal:

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Butan-1-ol to butanoic acid:

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- (c) Devise a method for distinguishing between the three liquid compounds, butan-1-ol, butanoic acid, and butanoyl chloride, using only blue litmus paper and water. Explain each of the observations in your method, with reference to the structure of the organic compounds.

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**QUESTION THREE**ASSESSOR'S  
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- (a) (i) Three alcohol compounds are listed below.

methylpropan-2-ol

butan-1-ol

butan-2-ol

Compare and contrast the structures of the compounds above.

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- (ii) Describe how you could distinguish between the alcohols in (i) above, using chemical tests on the alcohols and/or their oxidation products.

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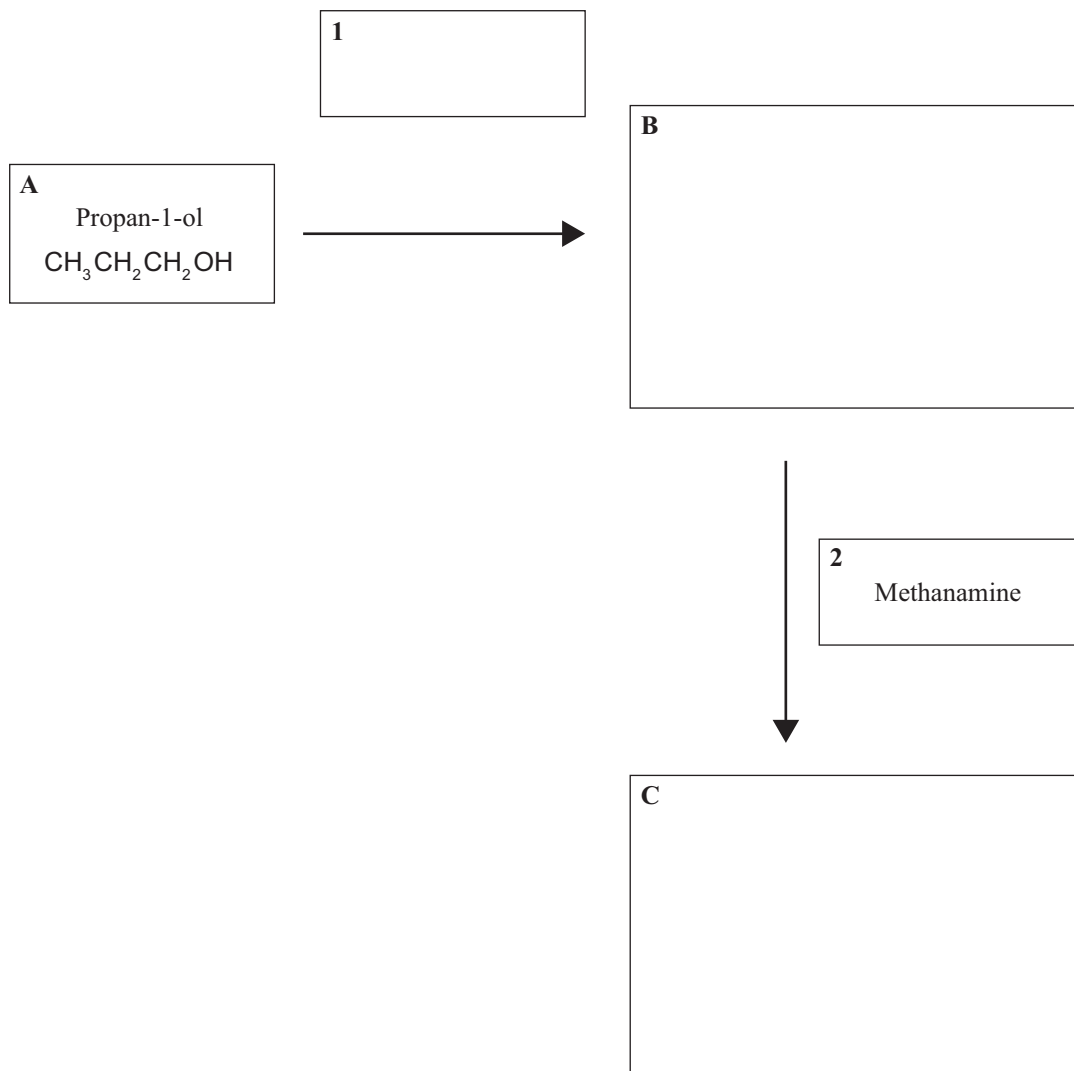
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- (b) Complete the following reaction scheme by drawing the structural formulae of the organic compounds **B** and **C**, and identifying reagent **1**.

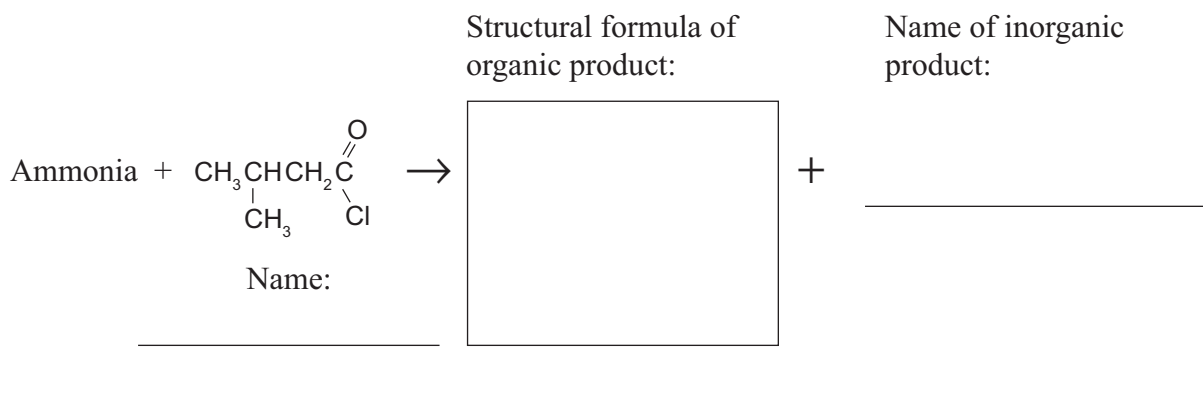
Include any necessary conditions, needed to bring about the transformation from reactant **A** to the organic compound **C**, which is a **base**.



Question Three continues on  
the following page.

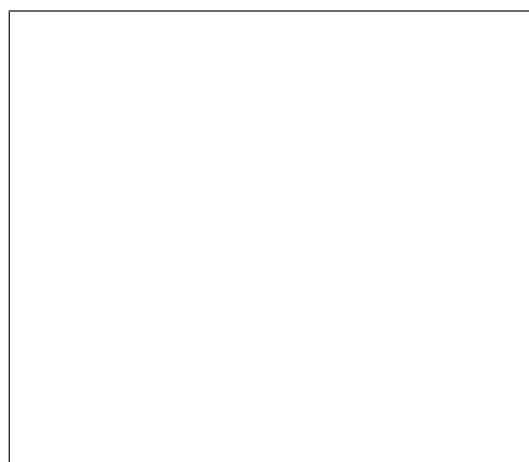
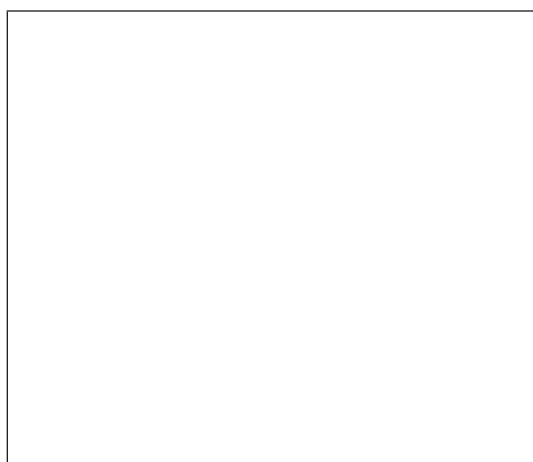
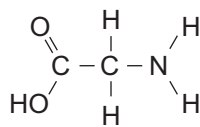
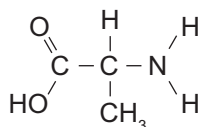
- (c) When ammonia reacts with  $\text{CH}_3\underset{\text{CH}_3}{\text{CH}}\text{CH}_2\overset{\text{O}}{\parallel}{\text{C}}\text{Cl}$ , two products are formed.

Complete the equation below by naming compounds or drawing the structure.



- (d) Peptides are formed when amino acids combine.

- (i) In the boxes below, show two possible dipeptides that can be formed by combining the amino acids:



- (ii) Circle the amide link in each dipeptide.



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