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91391

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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

Level 3 Chemistry, 2014

91391 Demonstrate understanding of the properties of organic compounds

2.00 pm Tuesday 11 November 2014
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 2–15 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.

Merit

TOTAL 16

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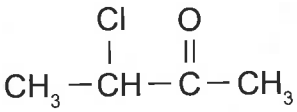
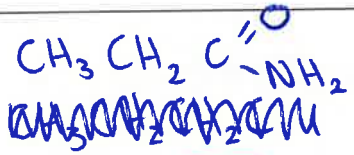
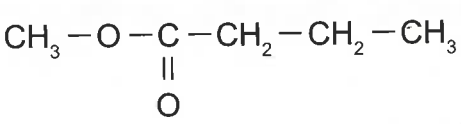
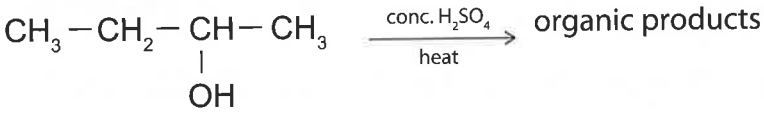
QUESTION ONE

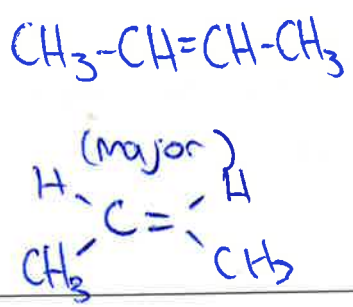
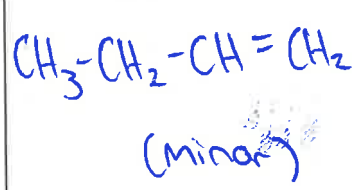
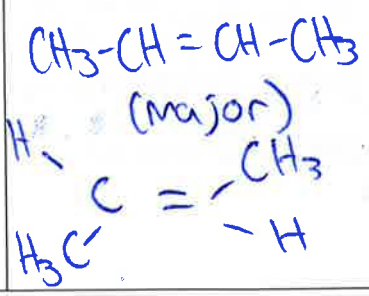
(a) Complete the table below giving the IUPAC systematic name or the structural formula for each compound.

Structural formula	IUPAC systematic name
	2 chloro butanone
	propanamide
	methyl butanoate

(b) When butan-2-ol undergoes a reaction with concentrated H_2SO_4, three possible organic products form, which are isomers of each other.



(i) In the boxes below, draw the three isomers formed during this reaction.

1	2	3
cis  (major)	 (minor)	trans  (major)

(ii) Which of the three isomers from part (i) will be formed in the smallest amount? Explain your answer.

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The minor product $CH_3CH_2-CH=CH_2$ or but-1-ene because when the reaction takes place, the double bond is in favour of forming between the carbon that lost the OH group and the carbon with the least number of Hydrogens attached to it.* Therefore there will be less of but-1-ene formed as it is the minor product.

* to form the major product //

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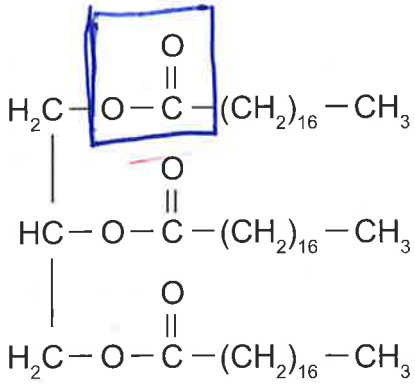
(c) The triglyceride below is shown in condensed form.



(i) Circle a functional group on the diagram above and give its name.

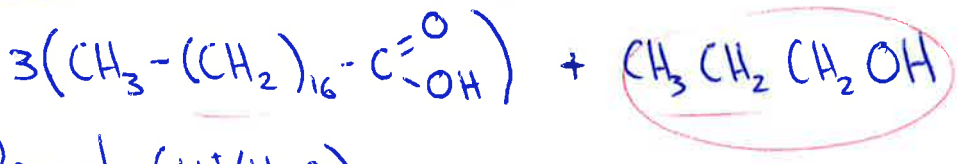
Functional group name: ester

(ii) Compare and contrast the reaction of the above triglyceride when it undergoes both acidic and basic hydrolysis.

In your answer you should include:

- drawings of condensed structures of the organic products
- any reagents and conditions required for the reaction to proceed.

Acidic



Reagent (H^+/H_2O)

Alkali

Reagent (NaOH)

Both reaction are hydroloysis. The acidic hydrolysis will react with the triglyceride and split it up into a carboxylic acid and a primary alcohol. The reagent used is (H^+/H_2O) which is the acidic reagent. The Basic hydrolysis uses NaOH as its reagent to form a carboxylate salt and a primary alcohol //

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QUESTION TWO

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(a) Identify the reagents, conditions required, and observations linked to species, to enable the following pairs of chemicals to be distinguished from each other.

(i) Aqueous solutions of propanamine and propanamide.

(ii) Propanone and propanal.

Used tolens reagent in both solutions, only the aldehyde, propanal will ~~oxidise~~ react to form a silvery mirror on the glass equipment. The ketone, propanone will not oxidise.

(iii) Propanoyl chloride and propyl propanoate.

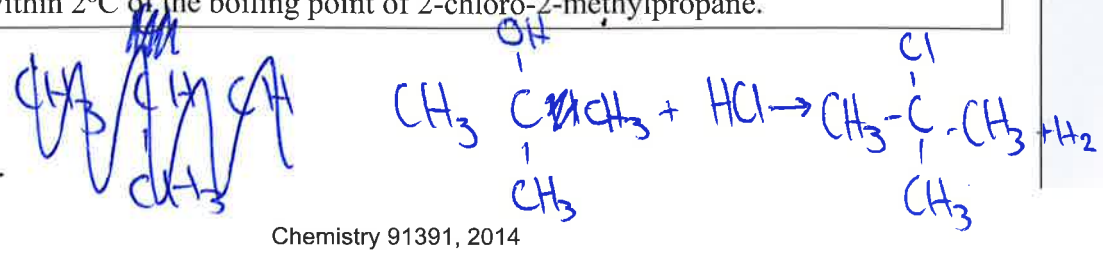
Add damp blue litmus to both solutions. Only the acid chloride, propanoyl chloride will react due to its acidic properties and turn the blue litmus red. The ester, propyl propanoate will not react with the litmus paper.

0 0

(b) Instructions for the preparation of 2-chloro-2-methylpropane are given below.

Read the instructions carefully and answer the questions that follow.

1.	Shake 10 mL of 2-methylpropan-2-ol with 30 mL of concentrated hydrochloric acid in a separating funnel for 10 minutes.
2.	Run off the bottom acid layer and discard it. Add saturated sodium hydrogen carbonate to the organic product. Shake, releasing the tap every few seconds to relieve the pressure.
3.	Run off the bottom aqueous layer and discard it. Transfer into a conical flask and add some anhydrous sodium sulfate, and stir thoroughly.
4.	Transfer the organic product into a round-bottom flask, and collect the fraction boiling within 2°C of the boiling point of 2-chloro-2-methylpropane.



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(i) Explain why the solution of sodium hydrogen carbonate is added in instruction 2.

Name the gas produced in this step.

Name of gas formed: Hydrogen

Explanation:

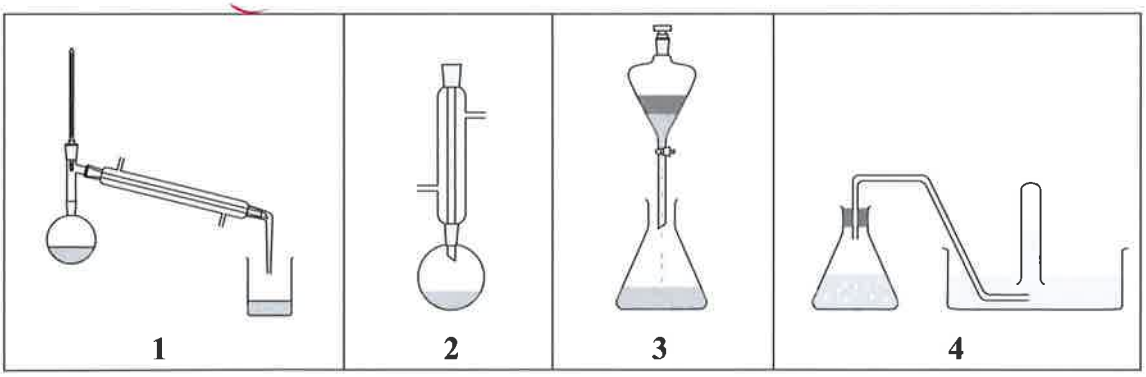
(ii) Explain why anhydrous sodium sulfate is added in instruction 3.

(iii) Name the process used in instruction 4 to purify the organic product.

Process used: distillation

Write the number of the equipment that a student would use to perform this process from the diagrams below.

Diagram no: 1



(iv) Discuss the process carried out in instruction 4 on page 6.

Include in your answer:

- the purpose of this process
- an explanation of how it works.

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Using distillation allows you to seperate two substances by boiling them without loosing any of the volatile substances. In the mixture, the substance with the lower boiling point is boiled off, but the vapour is then condensed back to liquid and collected seperately

M5

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The examination continues on the following page.

QUESTION THREE

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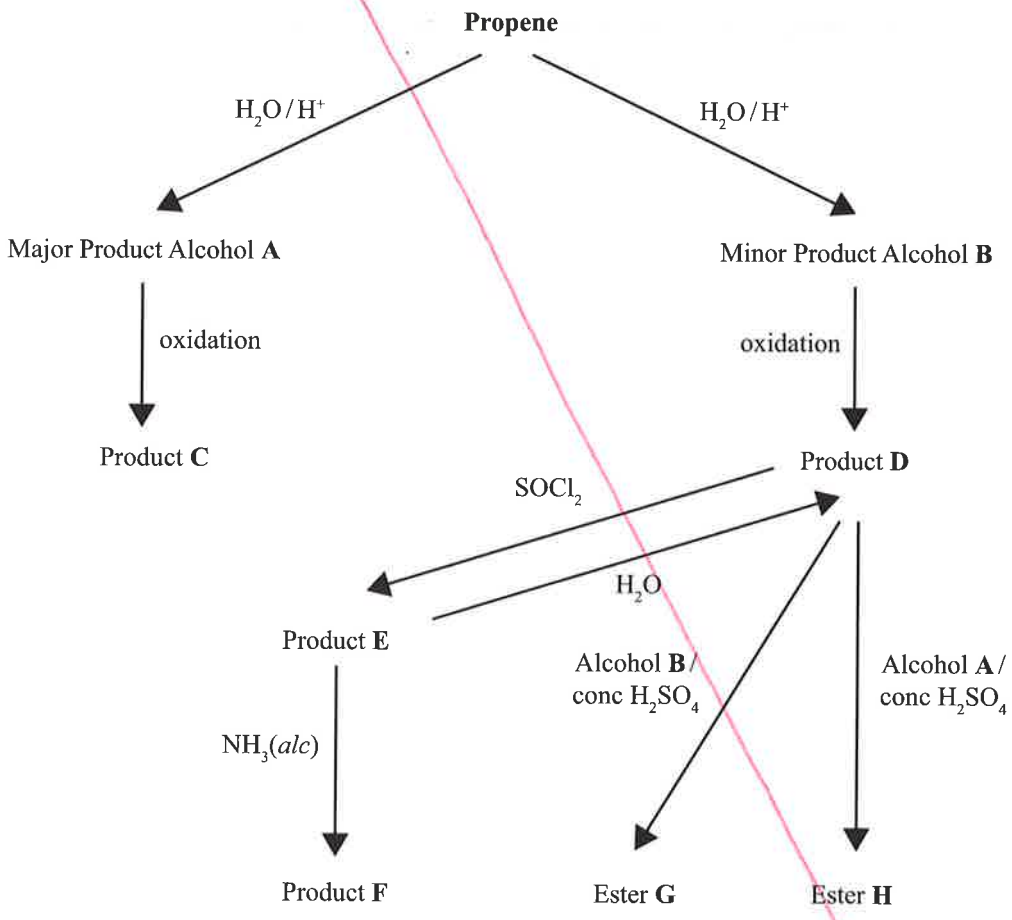
(a) Propene can be reacted with water in the presence of acid to form a major product (**A**) and a minor product (**B**).

- **A** is oxidised to form product **C**.
- **B** is oxidised to form product **D**.
- When **D** is reacted with $SOCl_2$, it forms product **E**.
- When **D** is reacted with alcohol **B**, it forms an **ester G**.
- When **D** is reacted with alcohol **A**, it forms **ester H**, which is an isomer of **G**.
- When **E** is reacted with alcoholic ammonia, it forms product **F**.
- When **E** is reacted with water, it forms product **D**.



Name compounds **A** to **G**, and draw structural formulae for compounds **A** to **H**.

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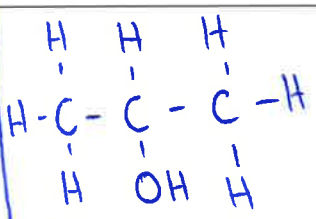
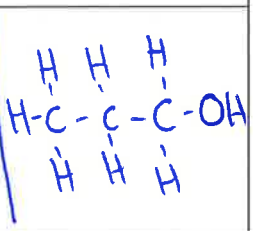
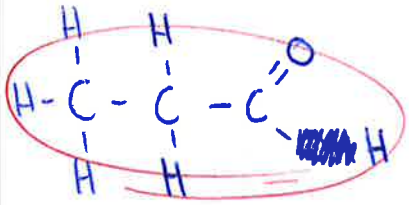
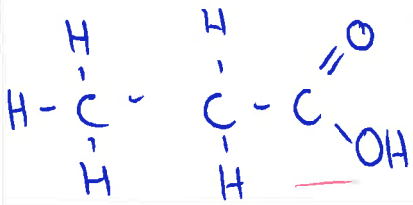
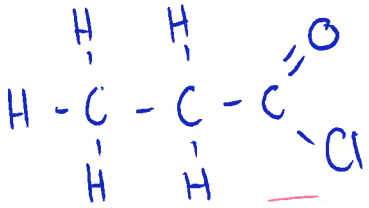
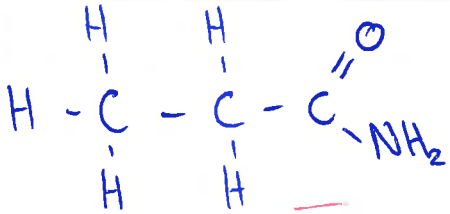
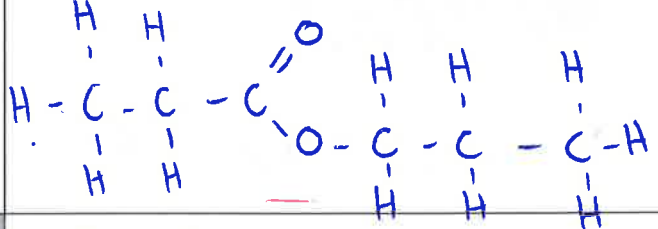
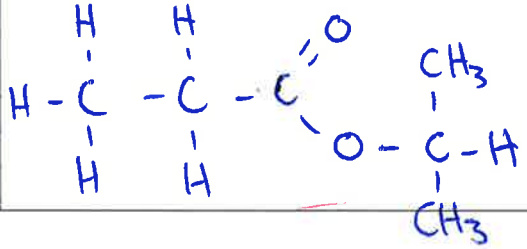
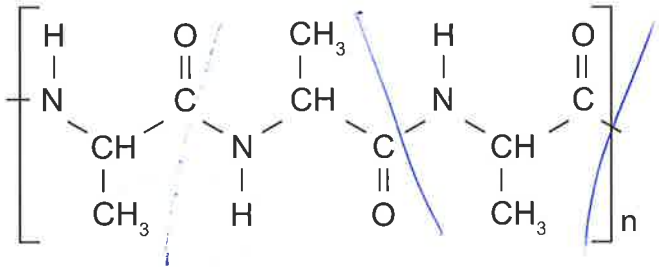
	Name	Structural Formula
A	propan-2-ol	$CH_3\text{-}CH(OH)\text{-}CH_3$ 
B	propan-1-ol	$CH_3\text{-}CH_2\text{-}CH_2OH$ 
C	propanal	
D	propanoic acid	
E	propanoyl chloride	
F	propan amide	
G	propyl propanoate	
H		

(b) The following polymer will, under the correct conditions, hydrolyse.



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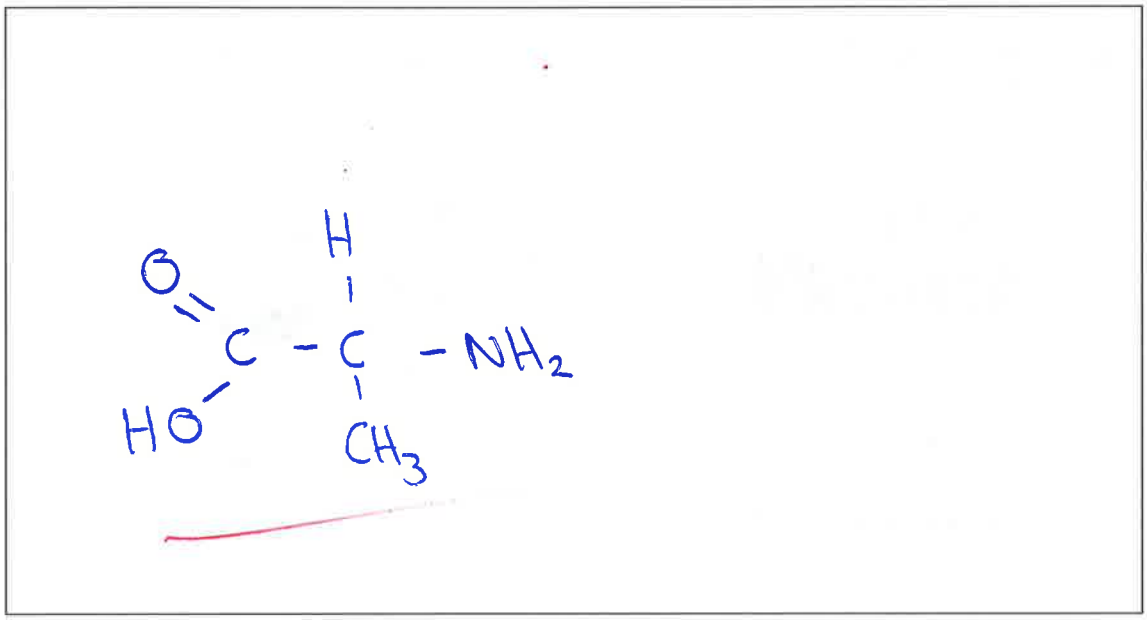
(i) Draw the monomer(s) from which this polymer is formed.



(ii) Discuss the hydrolysis of the polymer.

In your answer you should include:

- the conditions under which it can be hydrolysed
- structures of the organic products formed as a result of hydrolysis.

When the molecule undergoes hydrolysis, it splits up into two organic products in this case an ester, propanoate and ammonia.

$NH_2CH_3CCOOH \xrightarrow{H^+/H_2O} NH_3 + CH_3CHC{=}O{:}$

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Merit

Q1

(b)(ii) Good explanation, specifically identifying groups eliminated and from which carbon atoms they are eliminated from.

(c)(ii) The carboxylic acid and carboxylate salt were correctly drawn however, they did not identify that a triol was formed.

Q2

(a) 2 pairs of species formed

b (i) & (ii) A lack of practical understanding

(b)(iv) The purpose of distillation to separate substances based on different boiling points and how the apparatus allows this was discussed.

Q3

(a) C incorrectly identified as an aldehyde when a carboxylic acid was produced

(b)(ii) Poor understanding of hydrolysis of polyamides