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90309

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

National Certificate of Educational Achievement
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Level 2 Chemistry, 2005

90309 Describe the structural formulae and reactions of compounds containing selected organic functional groups

Credits: Four
2.00 pm Wednesday 23 November 2005

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 answer ALL the questions in this booklet.

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 2–9 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.

For Assessor's use only	**Achievement Criteria**		
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Describe structures and reactions of organic compounds.	Link structure and reactivity of organic compounds.	Discuss reactivity and structure of organic compounds.
Overall Level of Performance		

You are advised to spend 45 minutes answering the questions in this booklet.

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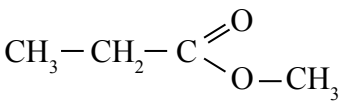
QUESTION ONE

(a) Complete the following table to show the structural formula and IUPAC (systematic) name for each of the organic compounds.

	Structural formula	IUPAC name
(i)	$CH_3-CH_2-CH_2-Cl$	
(ii)		
(iii)		4–methylpent–2–ene
(iv)		butanoic acid

(b) Identify the organic family (homologous series) for each of the compounds in the table above.

(i) _____

(ii) _____

(iii) _____

(iv) _____

QUESTION TWO

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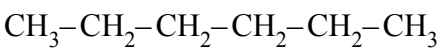
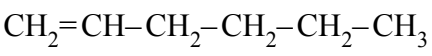
(a) (i) Identify a **chemical test** to distinguish between propanoic acid and propan-1-ol.

(ii) Describe the test to be carried out and the expected observations for each compound.

(b) The structural formulae for two compounds are given below:



hexane



hex–1–ene

Both compounds will react with bromine (Br_2), but under different conditions.

Discuss how the reactions with bromine could be used to distinguish between **hexane** and **hex–1–ene**.

In your answer include a description of expected observations, the conditions necessary for a reaction to occur, the type of reaction occurring and explanation for this, relevant equations and names of any products formed.

QUESTION THREE

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Two alkenes, but–1–ene and but–2–ene, are structural isomers of the compound with the molecular formula, C_4H_8.

$CH_2=CH-CH_2-CH_3$ but–1–ene

$CH_3-CH=CH-CH_3$ but–2–ene

(a) Draw and name **another** structural isomer of the compound, C_4H_8.

(b) But–2–ene can exist as geometric (*cis–trans*) isomers, whereas but–1–ene cannot.

Explain this difference, using structural formulae to illustrate your answer.

QUESTION FOUR

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Four alcohols with the molecular formula $C_4H_{10}O$ are shown in the table below.

(a) Complete the table by classifying each alcohol as **primary**, **secondary** or **tertiary**.

	Name	Structural formula	Classification
(i)	butan–1–ol	$CH_3-CH_2-CH_2-CH_2-OH$	
(ii)	butan–2–ol	$CH_3-CH_2-\underset{\displaystyle OH}{\underset{\vert}{CH}}-CH_3$	
(iii)	2–methylpropan–1–ol	$\begin{array}{l} \quad CH_3 \\ \quad \vert \\ CH_3-CH-CH_2-OH \end{array}$	
(iv)	2–methylpropan–2–ol	$\begin{array}{c} CH_3 \\ \vert \\ CH_3-C-CH_3 \\ \vert \\ OH \end{array}$	

(b) Complete the following equations by drawing the structural formula of the organic products in the boxes provided.

(i) $\begin{array}{c} CH_3 \\ \vert \\ CH_3-C-CH_3 \\ \vert \\ OH \end{array}$ conc. H_2SO_4 and heat $\rightleftharpoons$ [ ]

(ii) $CH_3-CH_2-CH_2-CH_2-OH + CH_3-\underset{\displaystyle O}{\underset{\Vert}{C}}-OH \xrightleftharpoons{\text{conc. } H_2SO_4 \text{ and heat}}$ [ ] $+ H_2O$

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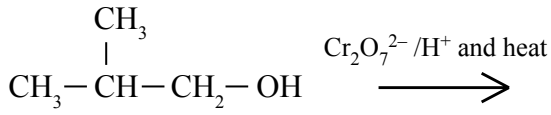
(iii) 

(c) Reaction (iii) above can also be carried out using one of the reagents shown below.

H_2 / Pt **conc. H_2SO_4** **MnO_4^- / H^+**

(i) Circle the correct reagent.

(ii) Describe what would be observed when this reaction occurs.

_____

_____

QUESTION FIVE

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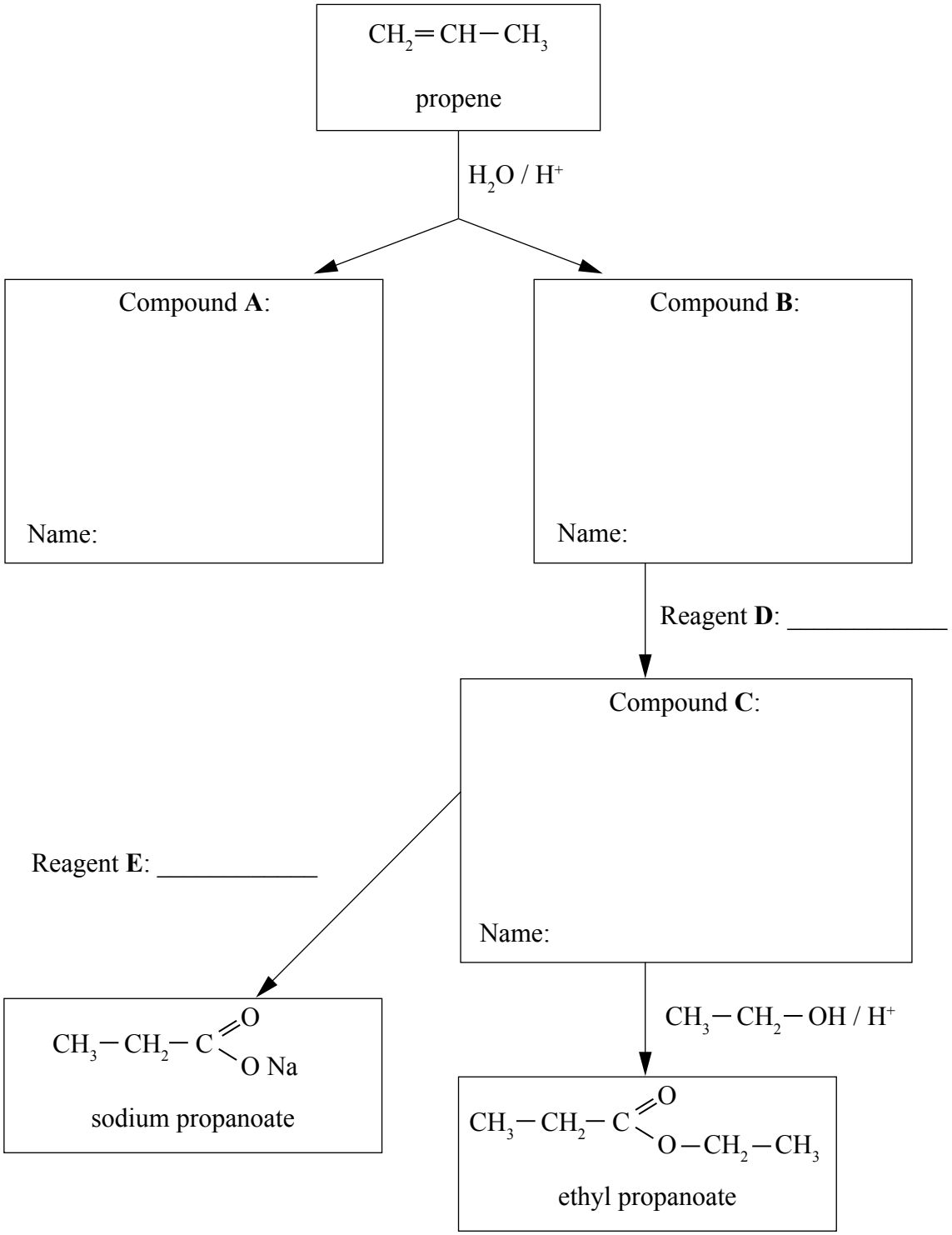
The flow diagram below shows a series of organic reactions.

Complete the diagram by drawing **structural formulae** and writing **IUPAC (systematic) names** for the compounds **A**, **B** and **C**, and identifying reagents **D** and **E**.



QUESTION SIX

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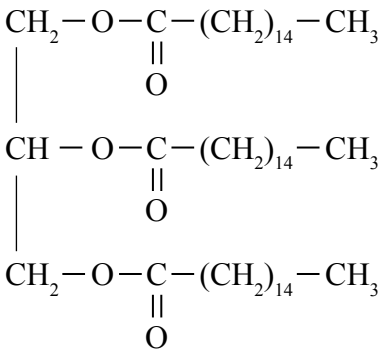
Palm oil contains the triglyceride with the structure shown below. It forms when glycerol (an alcohol) and palmitic acid (a carboxylic acid) react together.



(a) Use the diagram above to deduce the structural formulae of glycerol and palmitic acid.

Draw them in the spaces below.

glycerol

palmitic acid

(b) The triglyceride shown above can undergo hydrolysis in **acidic** or **basic** conditions.

How will the different hydrolysis conditions affect the products of the reaction?

Extra paper for continuation of answers if required.
Clearly number the question.

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Question number	