3

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91391

913910

NZQA

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QUALIFY FOR THE FUTURE WORLD
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Level 3 Chemistry, 2016

91391 Demonstrate understanding of the properties of organic compounds

2.00 p.m. Monday 21 November 2016
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 in 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 2–12 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 17

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QUESTION ONE

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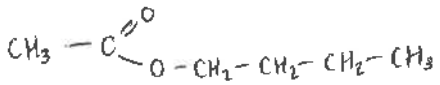
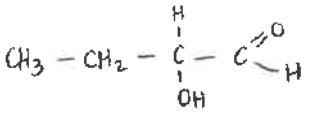
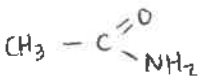
(a) Complete the table below by drawing the structural formula for the named compounds.

IUPAC systematic name	Structural Formula
butylethanoate	
2-hydroxybutanal	
ethanamide	

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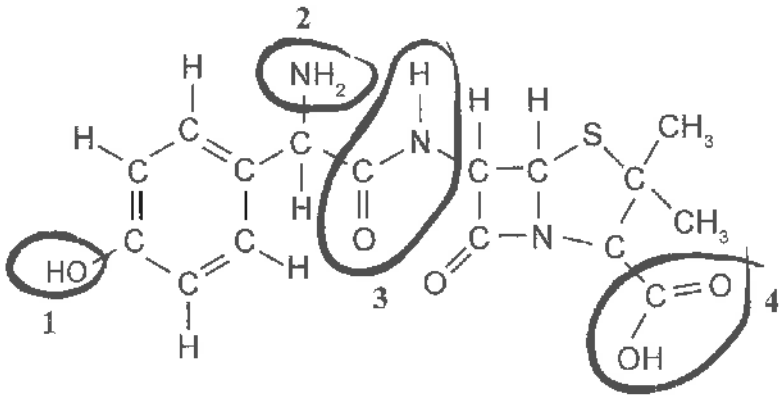
(b) The structure of amoxycillin is given below. It is an antibiotic used in the treatment of bacterial infections.



Name the four different functional groups circled within the amoxycillin molecule above.

1	Alcohol	2	Amine
3	Peptide (link)	4	Carboxylic acid

4

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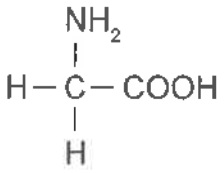
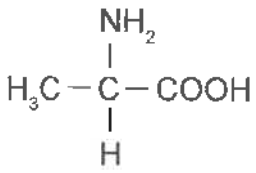
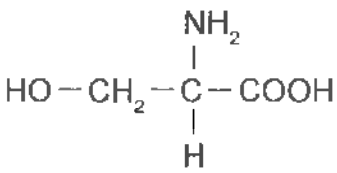
(c) Glycine, alanine, and serine are three amino acids shown below.



glycine

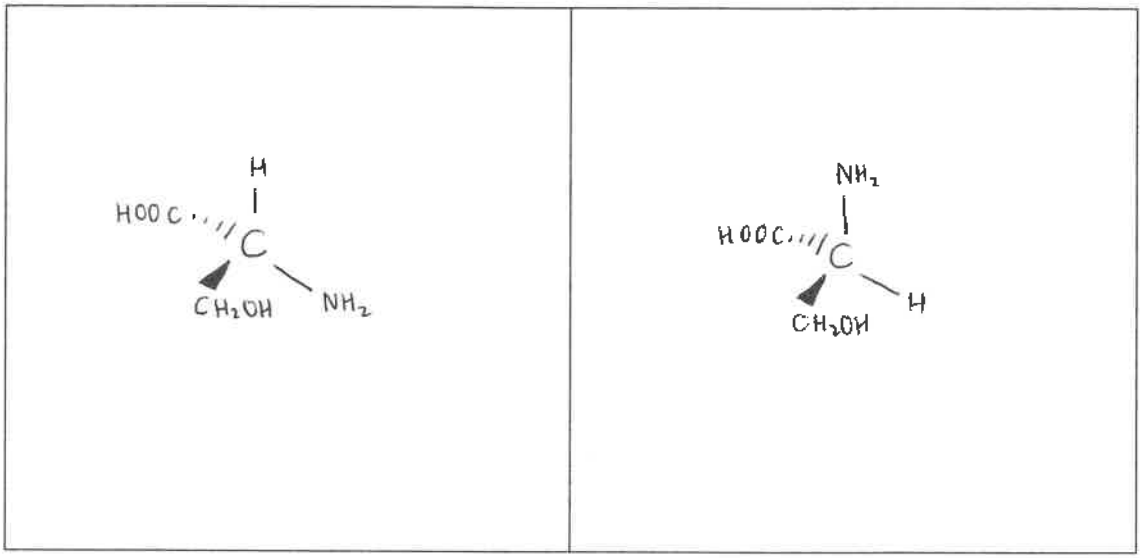


alanine



serine

(i) Draw the 3-D structures of the enantiomers (optical isomers) of **serine** in the boxes below.



(ii) Circle the amino acid below which does NOT display optical isomerism:

glycine **alanine** **serine**

Explain your answer.

An optical isomer is ~~a~~ isomers that cannot be superimposed and are mirror images of each other. Optical isomers require a chiral carbon, a carbon with 4 different groups attached to it. Glycine only has 3 different groups attached to it //

(iii) Draw the two possible dipeptides formed from the amino acids **glycine** and **alanine**.

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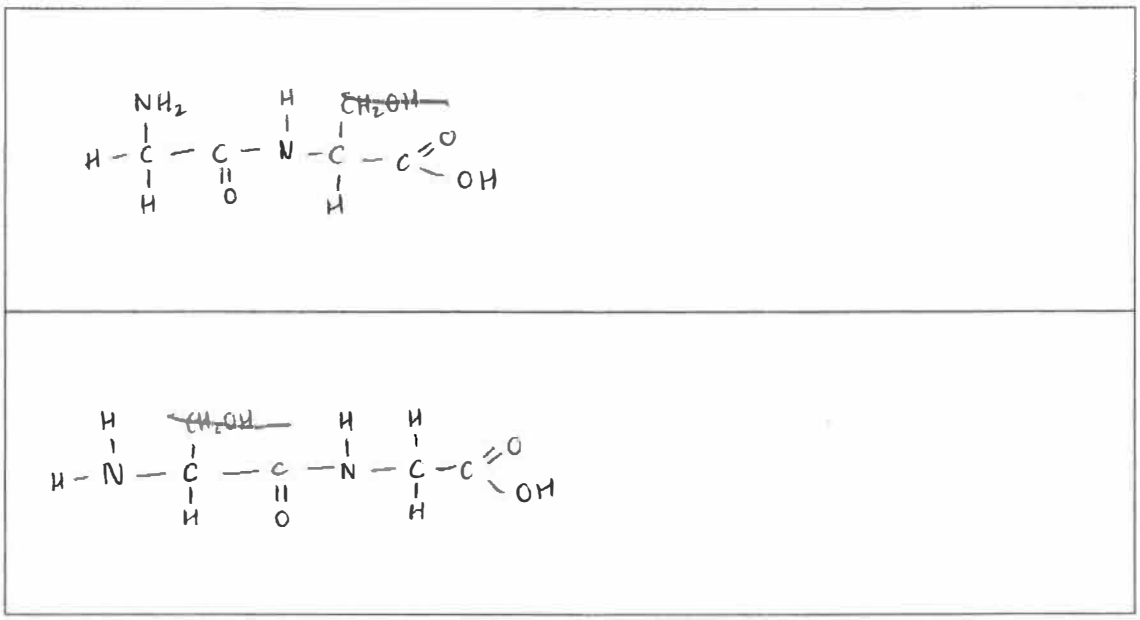


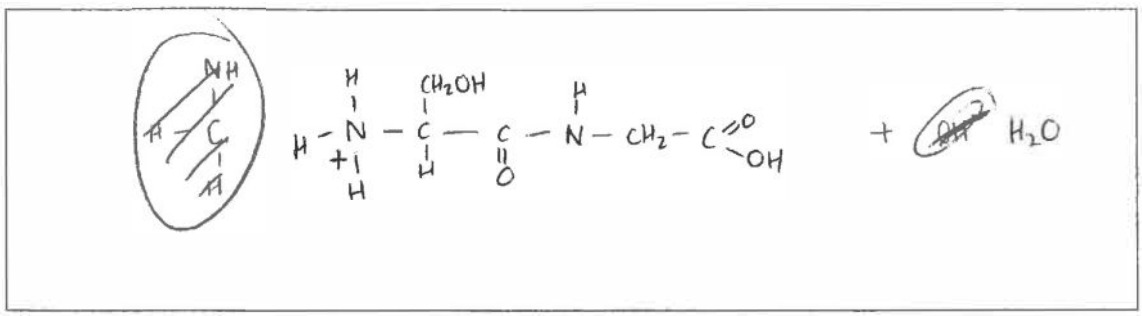
(iv) Name the type of reaction that occurred when the dipeptides formed in (iii) above.

Condensation polymerisation

Explain your choice.

Condensation polymerisation is the combining of monomers (glycine and alanine) to form a long chain molecule, the dipeptide. During this process, a molecule, H_2O, is ~~lost~~ removed.

(v) Draw the products of an acidic hydrolysis for ONE of the dipeptides from (iii) above.
Explain why these products are formed.



These products are formed because the dipeptide forms an $-NH_2$ end (amine) which is basic. When acid & base react, it ~~forms~~ neutralises and forms the salt and water.

M6

QUESTION TWO

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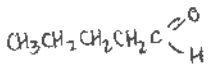
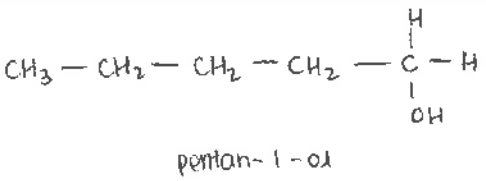
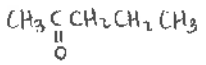
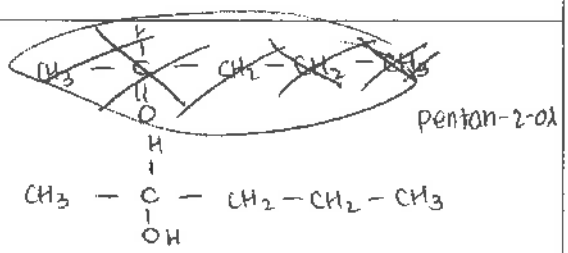
(a) (i) What reagent can be used to reduce aldehydes and ketones?

$NaBH_4$

(ii) For the **reduction** of pentanal and pentan-2-one, draw the structure of the organic product formed in each case.

Identify the functional group of each product formed.

pentanal 	Structure of the product:  pentan-1-ol Functional group: Primary Alcohol
pentan-2-one 	Structure of the product:  pentan-2-ol Functional group: Secondary alcohol

(b) The structures of four different organic substances are shown in the table below.

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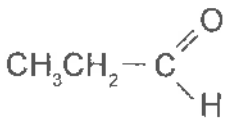
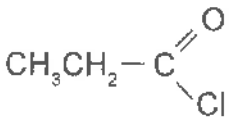
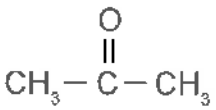
(i) Name the organic substances **A** to **D**.

Letter	Structure	Name
A	$CH_3CH_2CH_2-NH_2$	propan-1-amine
B		propanal
C		propanoyl chloride
D		propanone

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(ii) Explain how you would identify each of the organic substances, **A** to **D**, from the table in (b)(i), using only moist litmus paper, water, and Benedict's solution.

In your answer, you should include:

- a description of any tests carried out and any observations you would make
- equations to show the organic products formed, if applicable.

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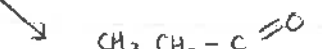
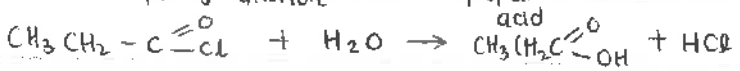
Start by adding wet red litmus to all substances

wet red litmus turns blue → $CH_3CH_2CH_2NH_2$ propan-1-amine

reacts with water (wet) & fizzes and fumes



propanoyl chloride

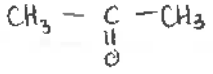


propanoic acid

no change

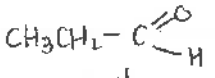
Add heated orange $Cr_2O_7^{2-}/H^+$ to the rest of the substances

no change →

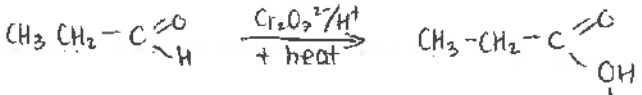


propanone

orange $Cr_2O_7^{2-}/H^+$ turns green



propanal



propanoic acid

QUESTION THREE

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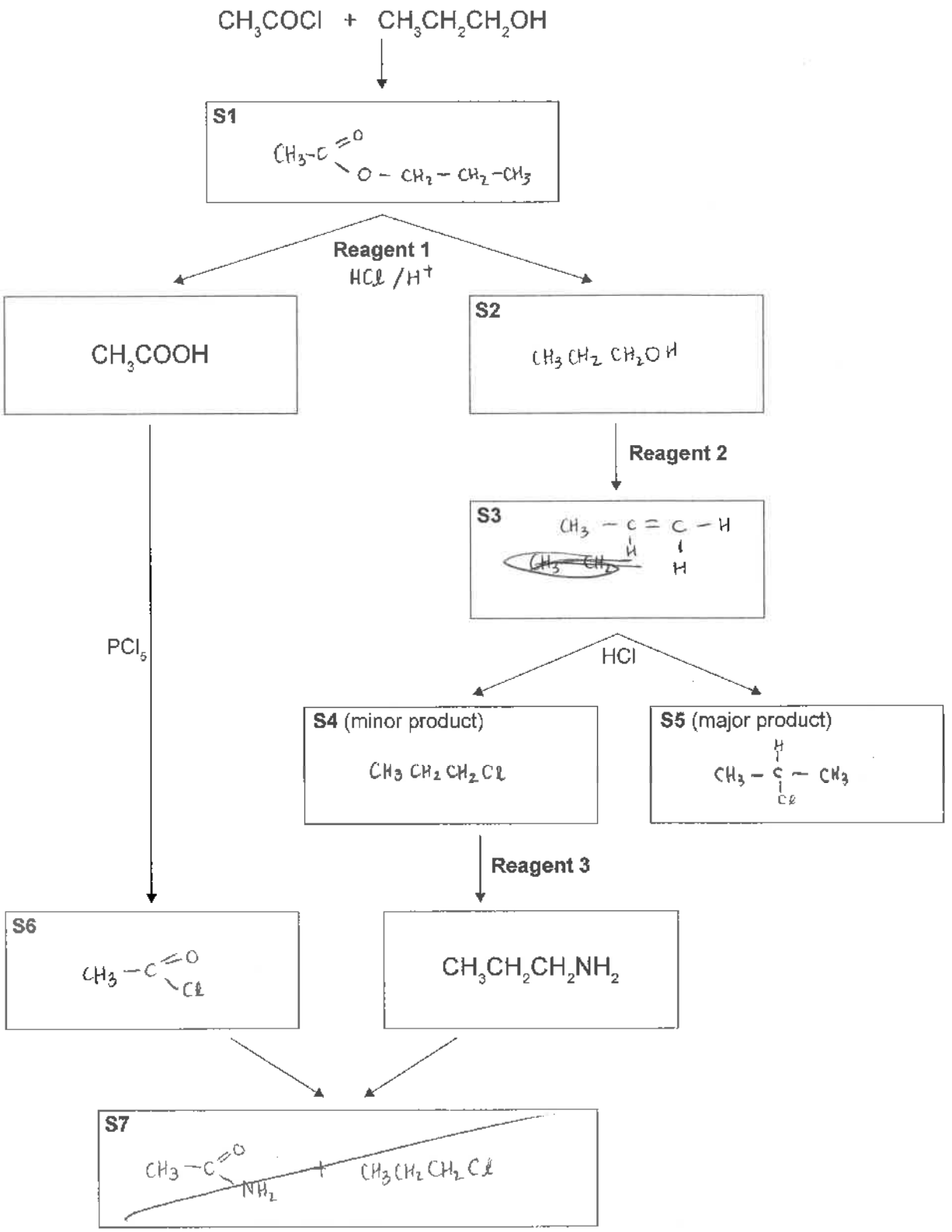
(a) Complete the following reaction scheme by drawing organic structures for **S1** to **S7**, and identifying reagents 1 to 3.



Reagent 1 is: HCl/H^+

Reagent 2 is: conc H_2SO_4

Reagent 3 is: conc. NH_3

(b) Draw a reaction scheme to show the conversion of **butan-1-ol** to **butan-2-one**.

You should include any relevant reagents, conditions required, and the structures of all organic substances involved.

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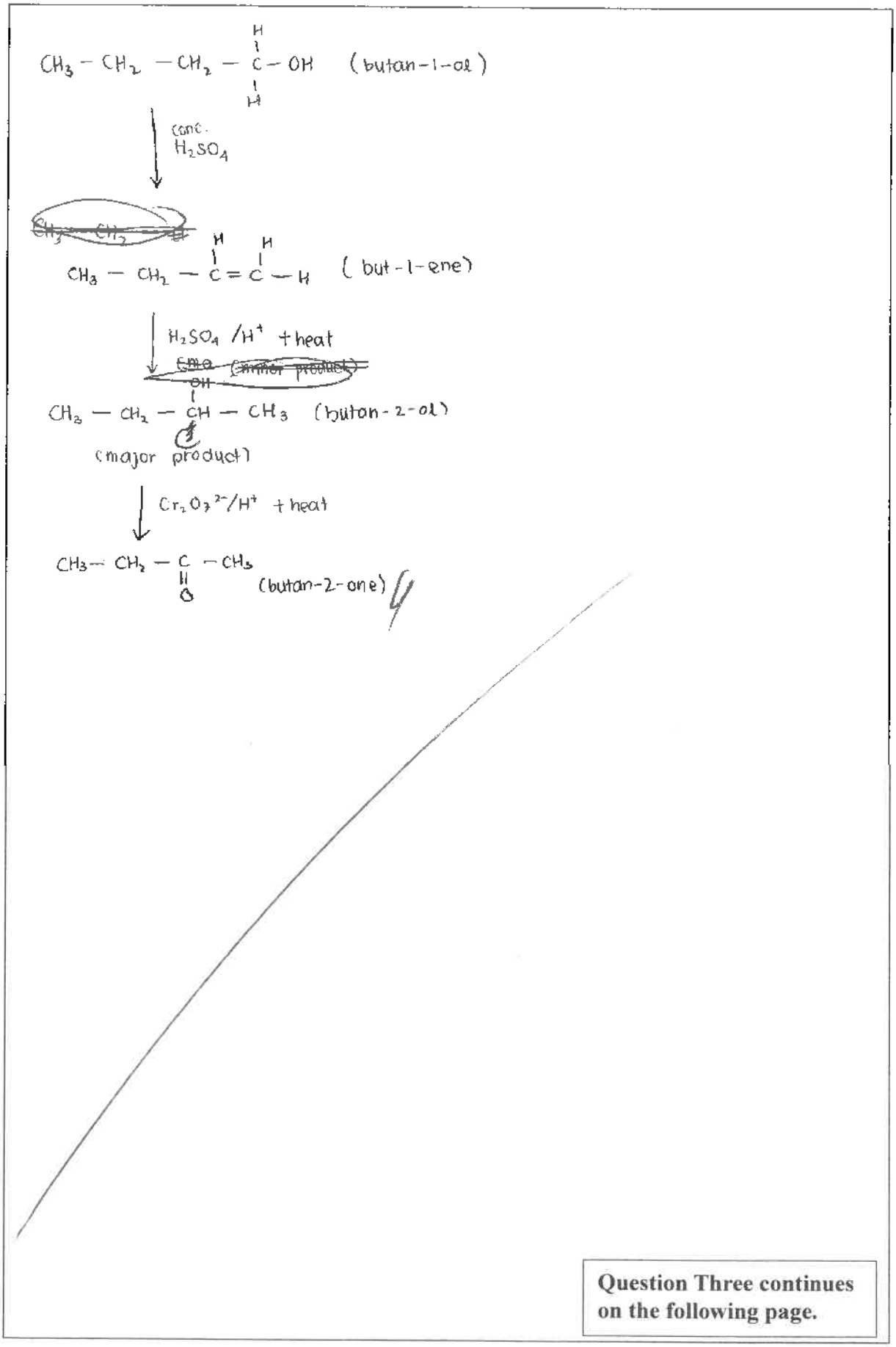

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Question Three continues on the following page.

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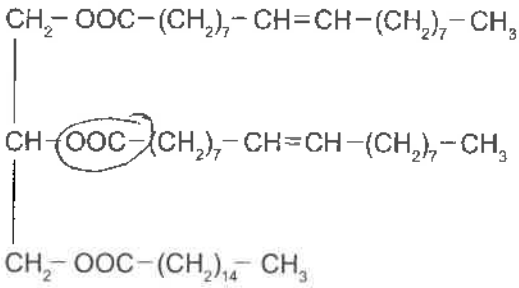
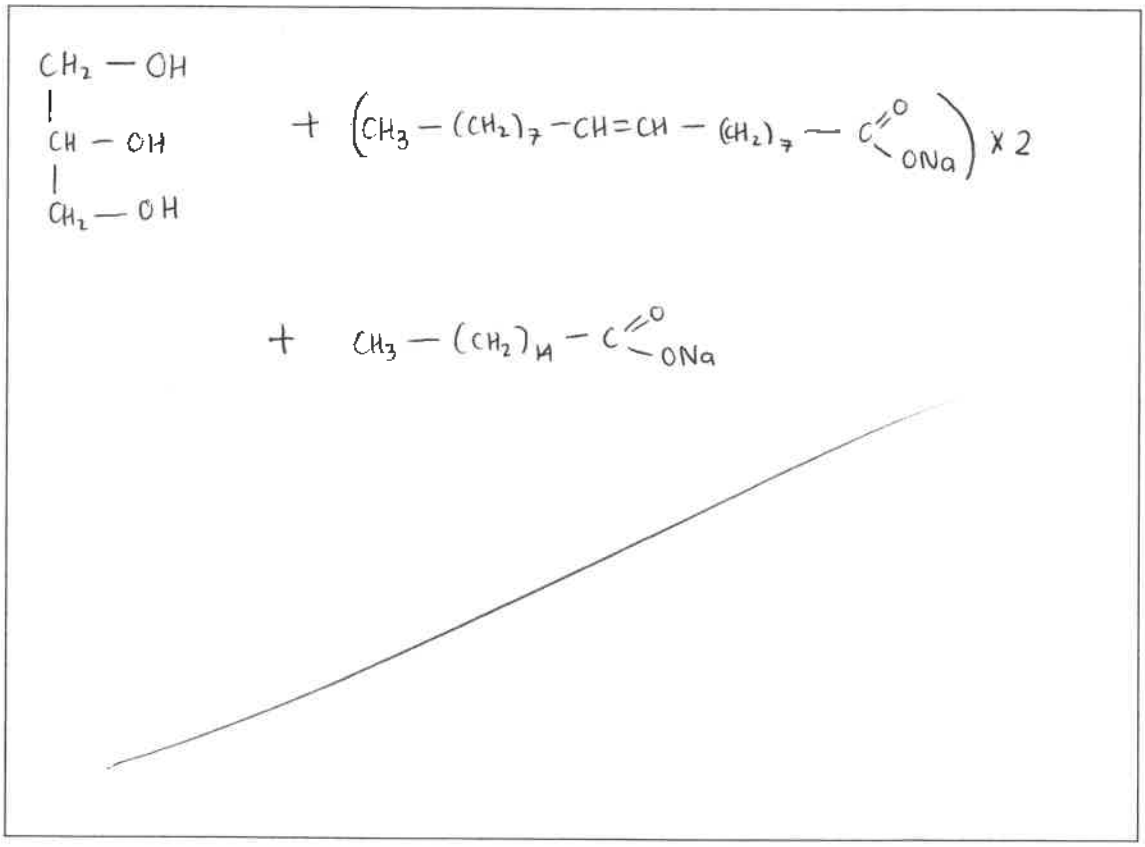
(c) A triglyceride found in olive oil has the following structure:



(i) Put a **circle** around one of the ester groups in the triglyceride molecule shown above.

(ii) Draw the structural formulae of the products produced by the hydrolysis of this triglyceride in basic conditions, using aqueous sodium hydroxide, NaOH.



Merit exemplar 2016

Subject:	Chemistry	Standard:	91391	Total score:	17

Q	Grade score	Annotation
1	M6	The candidate has drawn each structure correctly in part (a) and given the correct name for all four functional groups in part (b). The candidate can draw both 3-D diagrams correctly as well as correctly explain the requirements for optical isomerism. In part (c)(iii), the candidate has used serine instead of alanine but has carried out the process correctly. Had they used the correct amino acids they most likely would have excellence for this question. The candidate outlined correctly the type of reaction involved in part (c)(iv), however, in part (c)(v), the candidate has not drawn either product of hydrolysis but does show the amine group protonated and the carboxyl group.
2	M5	The candidate has parts (a) and (b)(i) correctly answered. In part (b)(ii), the candidate has the correct test and observations for the amine and acid chloride but goes on to use acidified dichromate which is not one of the listed reagents
3	M6	In part (a), the reaction scheme is essentially correct except for box S7. Had they correctly completed box S7 the candidate would have been awarded excellence and E8 for the question. A valid reaction scheme with correct structures, reagents and conditions is given for part (b). All aspects about the ester functional group and the hydrolysis of the triglyceride are correct.