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91391

913910

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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.

Achievement

TOTAL 11

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QUESTION ONE

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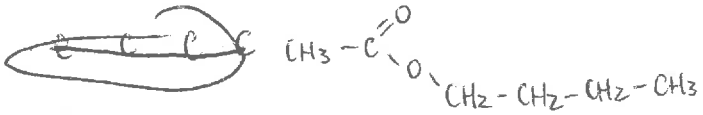
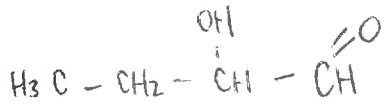
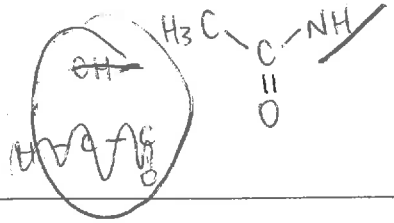
(a) Complete the table below by drawing the structural formula for the named compounds.

IUPAC systematic name	Structural Formula
butylethanoate	
2-hydroxybutanal	
ethanamide	

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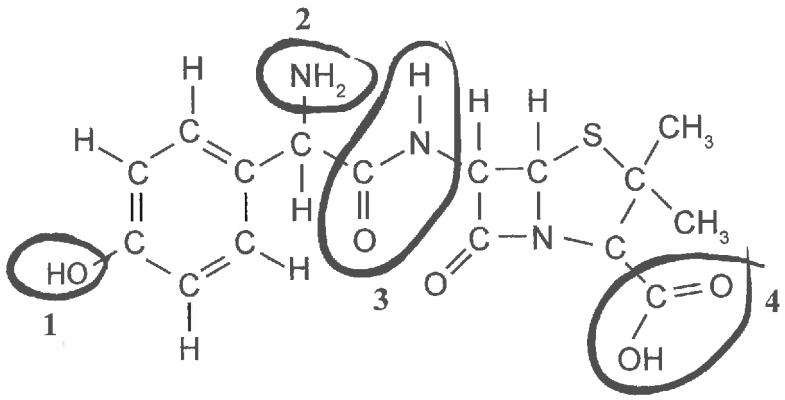
(b) The structure of amoxycillin is given below. It is an antibiotic used in the treatment of bacterial infections.



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

1	carboxyl
3	Amide

2	Amine
4	carboxylic acid

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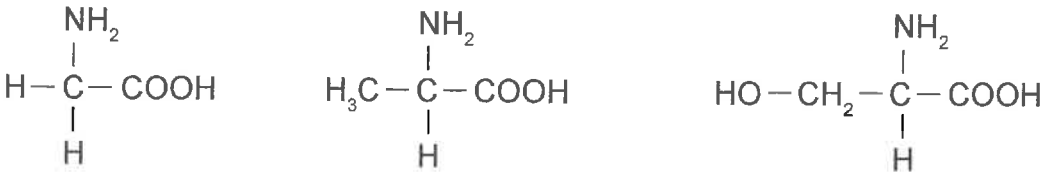
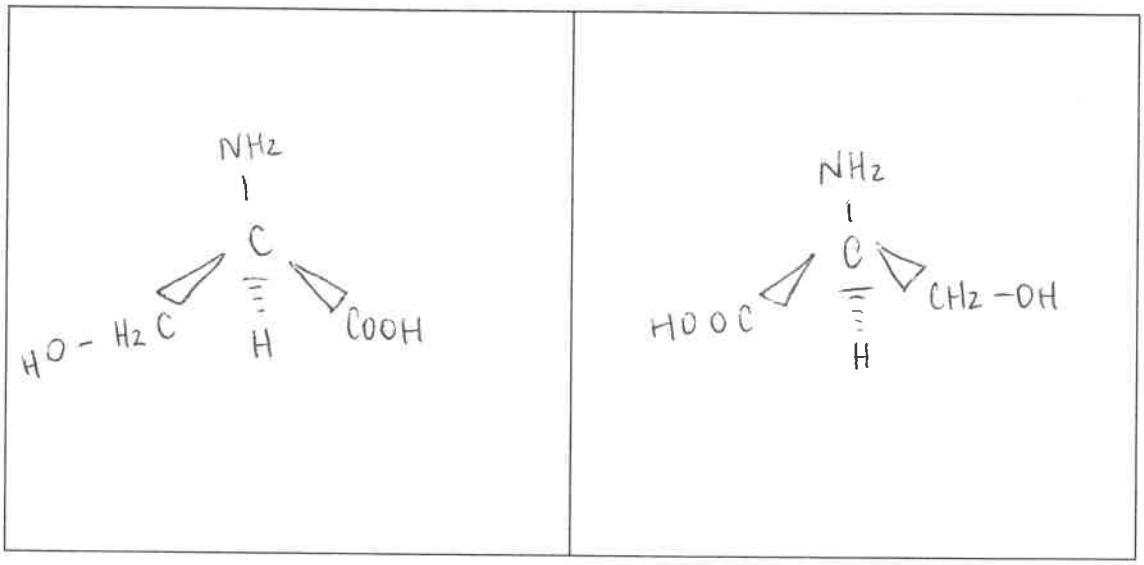
(c) Glycine, alanine, and serine are three amino acids shown below.



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.

For an optical isomer to exist, it must contain a chiral carbon. A chiral carbon is has four different atoms/groups of atoms attached to it. Glycine does not contain a chiral carbon.

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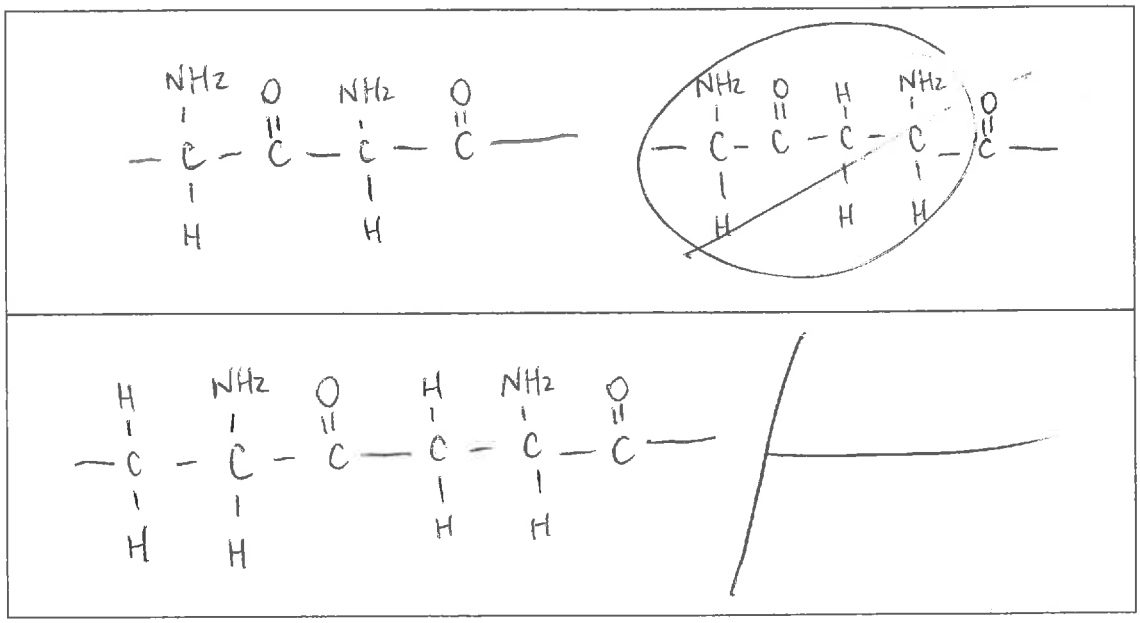
(iii) Draw the two possible dipeptides formed from the amino acids **glycine** and **alanine**.



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

Condensation ✓

Explain your choice.

In the reaction both a large molecule (the amino acid) and a small molecule (H_2O) are produced. ✓

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(v) Draw the products of an acidic hydrolysis for ONE of the dipeptides from (iii) above.

Explain why these products are formed.

A4

QUESTION TWO

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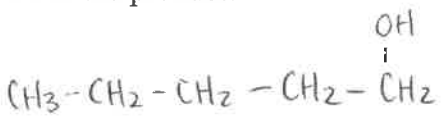
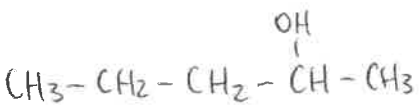
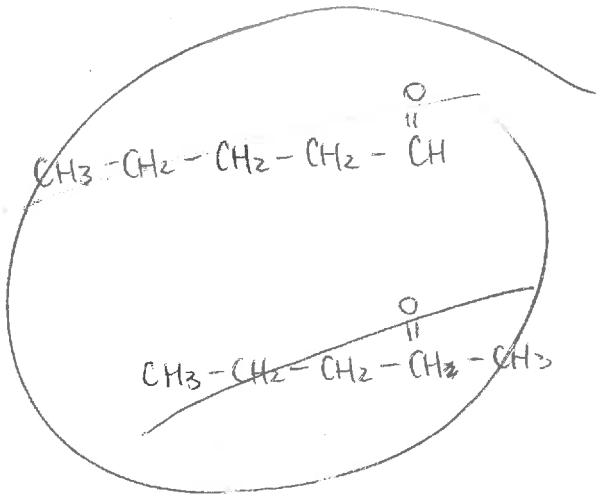
(a) (i) What reagent can be used to reduce aldehydes and ketones?

$NaBH_4$ / U

(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 Aldehyde	Structure of the product:  Functional group: carboxyl /(OH)/ U
pentan-2-one Ketone	Structure of the product:  Functional group: carboxyl /(OH)/



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

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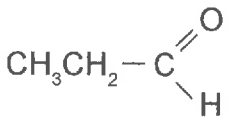
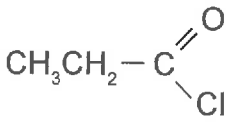
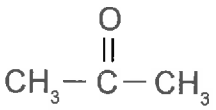
(i) Name the organic substances **A** to **D**.

Letter	Structure	Name
A	$CH_3CH_2CH_2-NH_2$	~~propan~~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. Cu^{2+} blue

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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First I would test each ~~one~~ with moist litmus paper. The litmus would turn blue in substance A as it is an amine and therefore basic. Substance B (the aldehyde) and substance D (the ketone) would not change the litmus. Substance C (the acyl chloride) would react violently with the water from the ~~paper~~ moist litmus. Bubbles would appear as HCl gas would be produced. Because of its reaction with water, substance C (the acyl chloride) would turn the litmus red as it would become acidic.

To distinguish between substance B (the aldehyde) and substance D (the ketone) I would add Benedict's solution. Substance B (the aldehyde) would change the blue Benedicts to a brick red colour. The other substances would remain blue.

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QUESTION THREE

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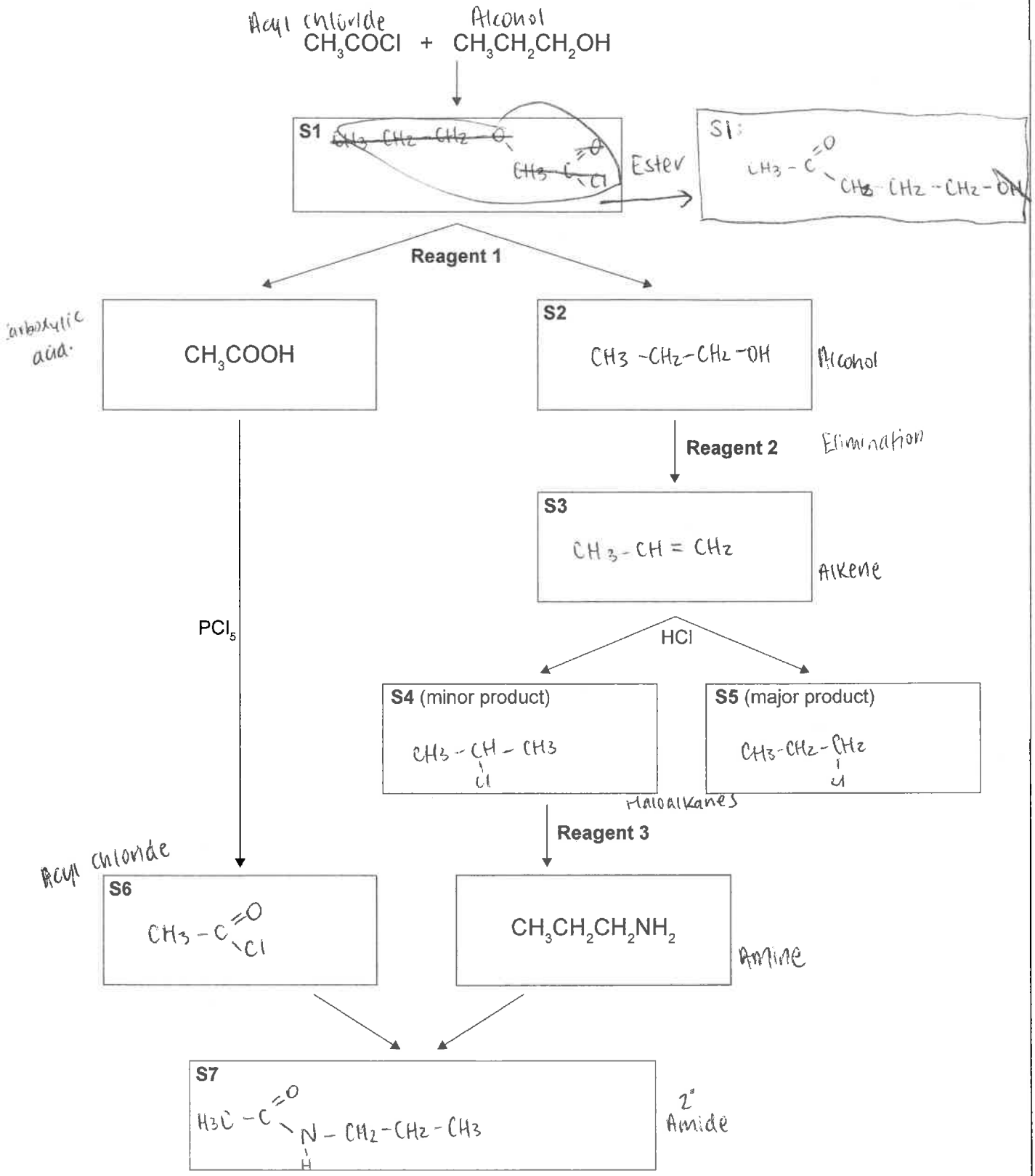
(a) Complete the following reaction scheme by drawing organic structures for **S1** to **S7**, and identifying reagents **1** to **3**.



Reagent 1 is: H_2O

Reagent 2 is: Concentrated H_2SO_4

Reagent 3 is: NH_3

Alcohol → ketone

(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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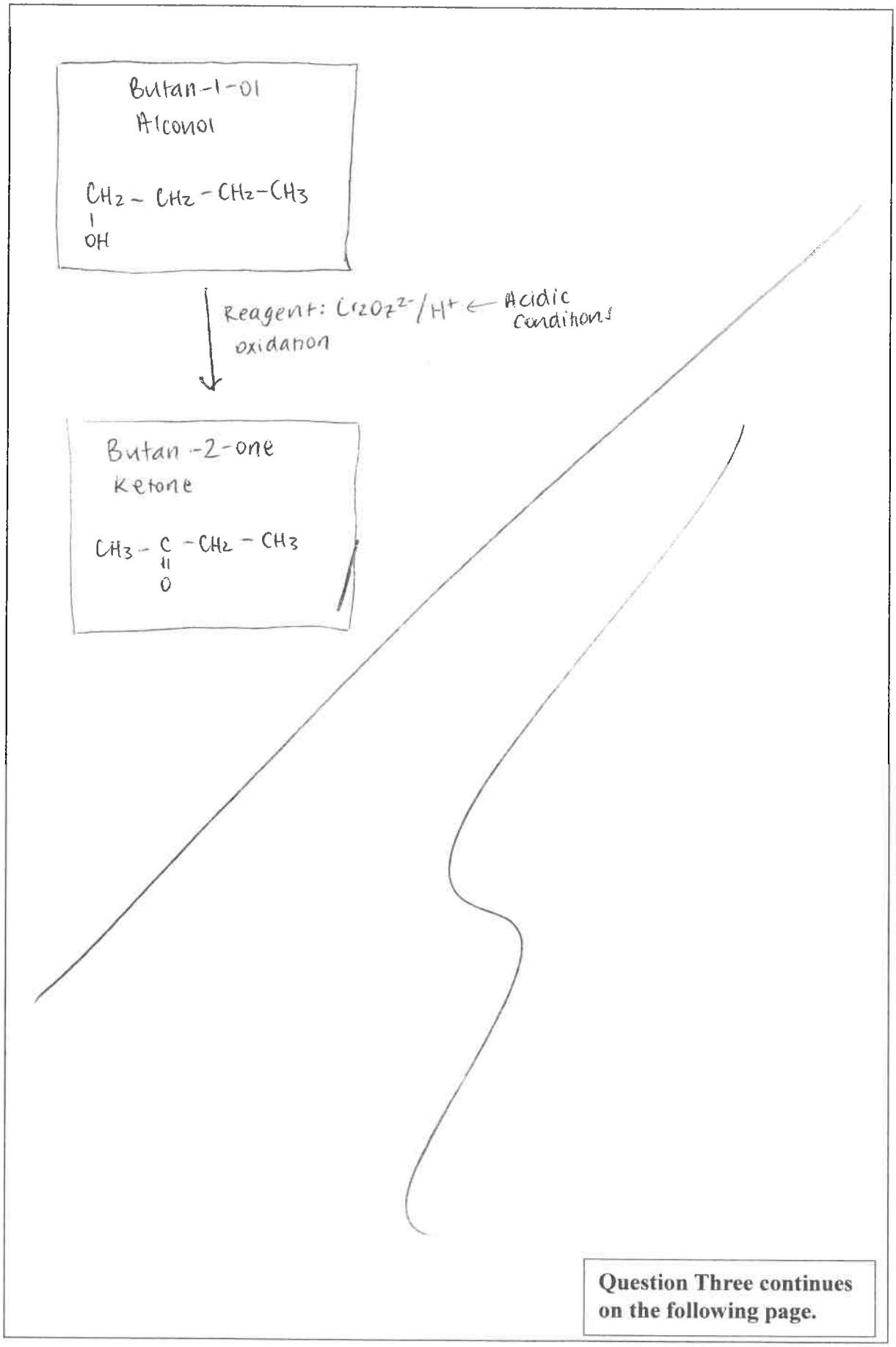

Question Three continues on the following page.

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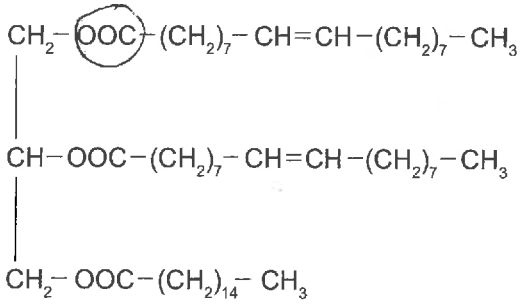
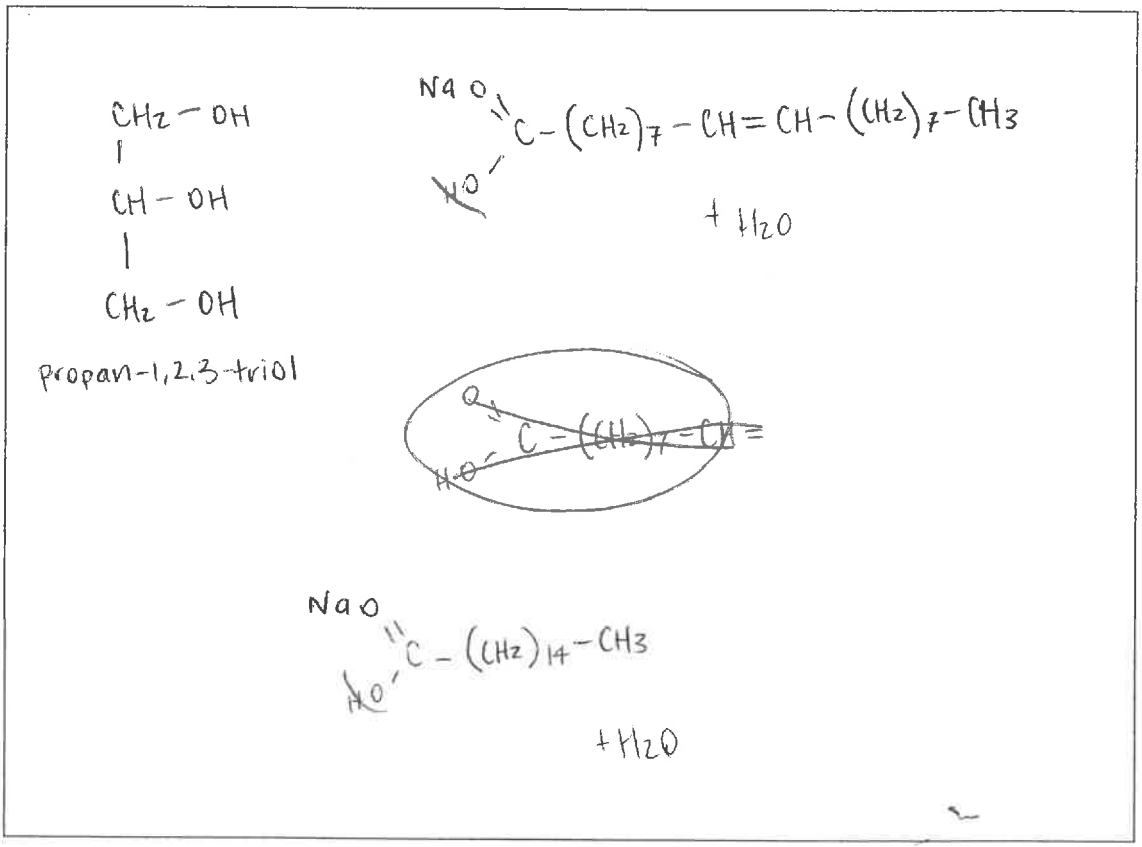
(c) A triglyceride found in olive oil has the following structure:



(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.



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A3

Achievement exemplar 2016

Subject:	Chemistry	Standard:	91391	Total score:	11

Q	Grade score	Annotation
1	A4	Two structures are correct in part (a). All groups are correctly named in part (b). In part (c), the correct 3D diagrams are produced, and a correct explanation for the requirements for optical isomerism is given. Part (c)(iii) shows the dipeptides are drawn as polymers which do not have a correct amide linkage. In part (c)(iv) the correct reaction type is given, but the explanation does not sufficiently link the joining of the two molecules with the formation of a small molecule. Part (c)(v) is not answered. The candidate could have gained a grade score of M5 if one of the dipeptides had been drawn correctly, or a fuller explanation was given to the classification of the condensation reaction.
2	A4	In part (a), the correct reagent, plus structures of each alcohol are given, but does not classify the alcohols as primary and secondary. In part (b)(i), three of the four organic compounds are named correctly. In part (b)(ii), the candidate chooses relevant tests and has correct observations for the acid chloride and aldehyde. To get a higher grade they would need to state the initial colour of the litmus used to identify the amine and write at least two correct equations.
3	A3	In part (a), there are six correct structures and one reagent. To be awarded excellence, box S1 would have to be correct, plus H^+ added to reagent 1 and (conc) or (alc) to reagent 3 In part (b), only the starting and final structures were drawn. In part (c)(i), the candidate correctly circles an ester functional group. In part (c)(ii), the glycerol structure is correct but not the fatty acids. All structures need to be correct for merit.