3

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91391

913910

NZQA

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QUALIFY FOR THE FUTURE WORLD
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Level 3 Chemistry, 2015

91391 Demonstrate understanding of the properties of organic compounds

2.00 p.m. Wednesday 11 November 2015
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 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.

Not Achieved

TOTAL 6

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QUESTION ONE

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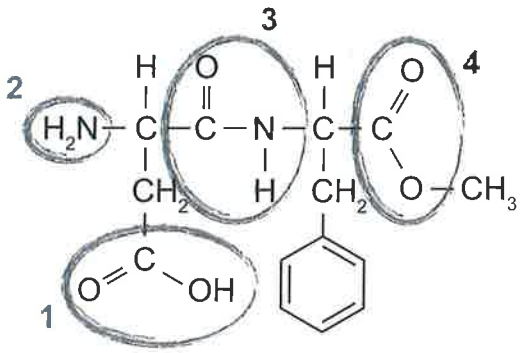
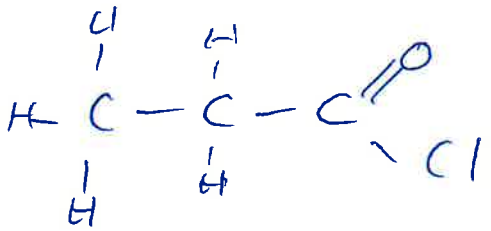
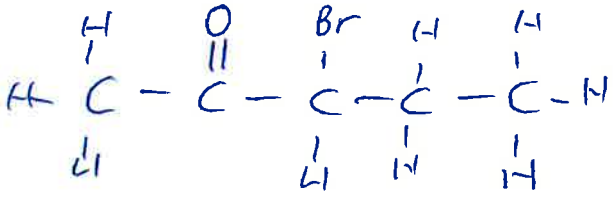
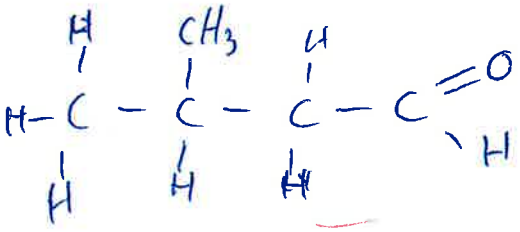
(a) The structure of aspartame is given below. Aspartame is often used as an artificial sweetener in drinks.



Identify the FOUR different functional groups within the aspartame molecule that are circled and numbered above:

1	Carboxylic acid	2	Amine
3	Amide	4	Ester

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

IUPAC systematic name	Structural formula
propanoyl chloride	
3-bromopentan-2-one	
2-methylbutanal	

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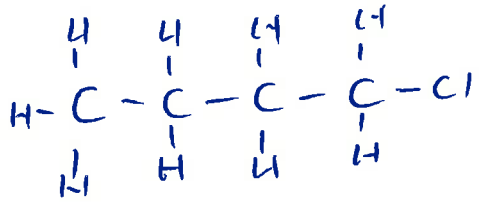
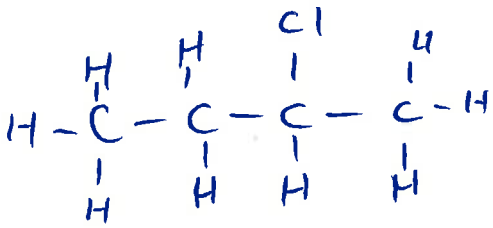
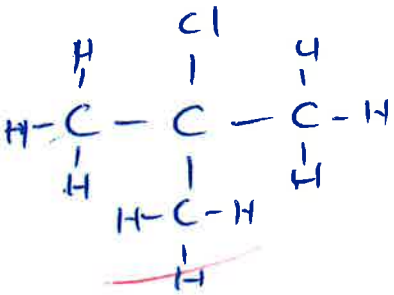
(c) (i) In the boxes below, draw the three structural isomers of C_4H_9Cl that represent a primary, secondary and tertiary haloalkane.

Primary haloalkane	Secondary haloalkane
	

Tertiary haloalkane


(ii) Elaborate on the reactions occurring when each of the haloalkane isomers from (c)(i) reacts with KOH in alcohol.

In your answer you should include:

- the identification of ALL organic products formed
- an explanation of the type of reaction taking place
- reasons for the formation of any major and minor products.

There is more space for your answer to this question on the following page.

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N2

QUESTION TWO

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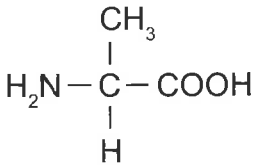
Alanine is an amino acid. Its structure is shown below.

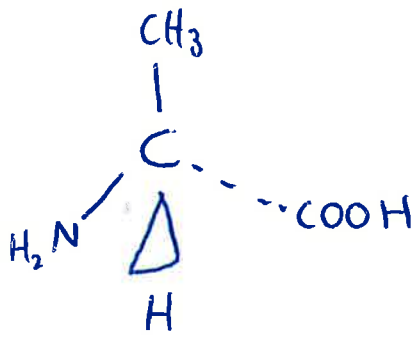


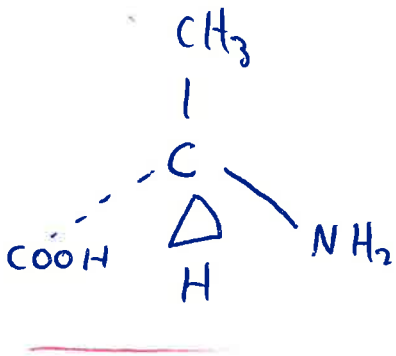
(a) (i) Describe the structural feature necessary for a compound to exist as enantiomers (optical isomers).

In order to be an optical isomer, the molecule must have a chiral centre, which is a carbon atom with 4 different organic groups attached.

(ii) Identify one physical property that is the same for both enantiomers of alanine, and one that is different, clearly describing how this property could be used to distinguish between the enantiomers.

(b) Draw 3-D structures of the enantiomers of alanine in the boxes below.





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(c) A form of the polymer nylon can be made from the two monomers below.

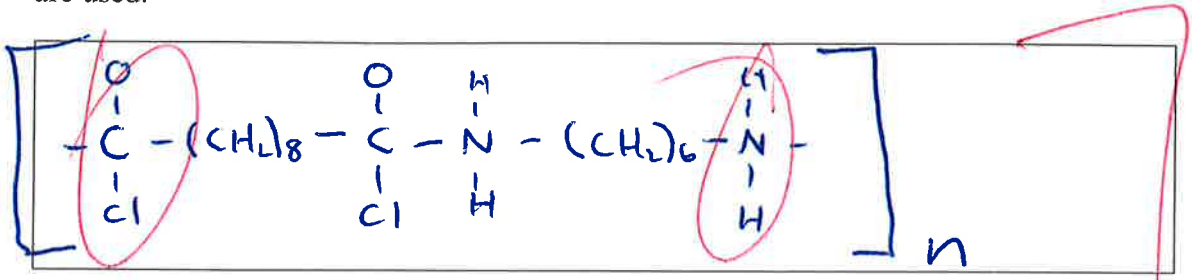
1,6-diaminohexane

$$H_2N-(CH_2)_6-NH_2$$

Sebacoyl chloride (decanedioyl dichloride)

$$Cl-\overset{\overset{O}{\|}}{C}-(CH_2)_8-\overset{\overset{O}{\|}}{C}-Cl$$

(i) In the box below draw the repeating unit of the polymer formed if these two monomers are used.



Consider the formation of this form of nylon in a laboratory.

(ii) Describe the type of reaction occurring, and explain why this reaction results in a polymer.

This is an addition polymerisation reaction where the double carbon oxygen bond is broken. 1

(iii) Explain why sebacoyl chloride is dissolved in a non-polar organic solvent rather than in water.

Sebacoyl chloride is non-polar as the polar bonds are arranged symetrically and non-polar solvents dissolve non-polar substances. Whereas non-polar substances do not dissolve in polar substances such as water, because the water sebacoyl chloride attraction is weaker than the intermolecular forces of sebacoyl chloride.

(iv) Elaborate on the reaction that will occur if a dilute aqueous solution of acid is mixed with the newly formed polymer.

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QUESTION THREE

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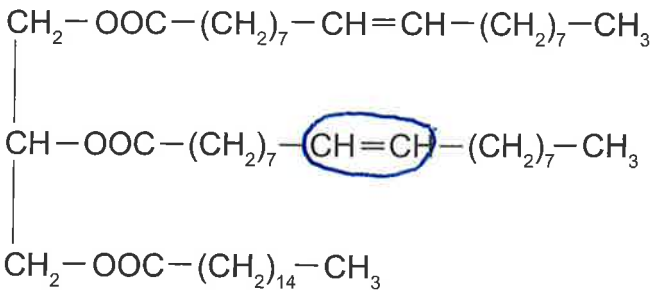
(a) A triglyceride has the following structure:



(i) Circle one of the alkene groups in the triglyceride molecule.

This triglyceride is described as unsaturated.

(ii) Describe a chemical test that can be used to show that the molecule is unsaturated.

Give any observations, and state the type of reaction occurring.

Add bromine water to the unsaturated molecule, if the bromine water doesn't decolourise then the molecule is unsaturated.

(iii) Draw the structural formulae of the organic products formed by hydrolysis of this triglyceride using aqueous sodium hydroxide.

(iv) Explain why the equipment below is used for hydrolysis of the triglyceride.

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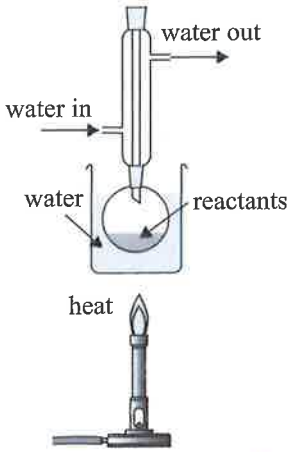
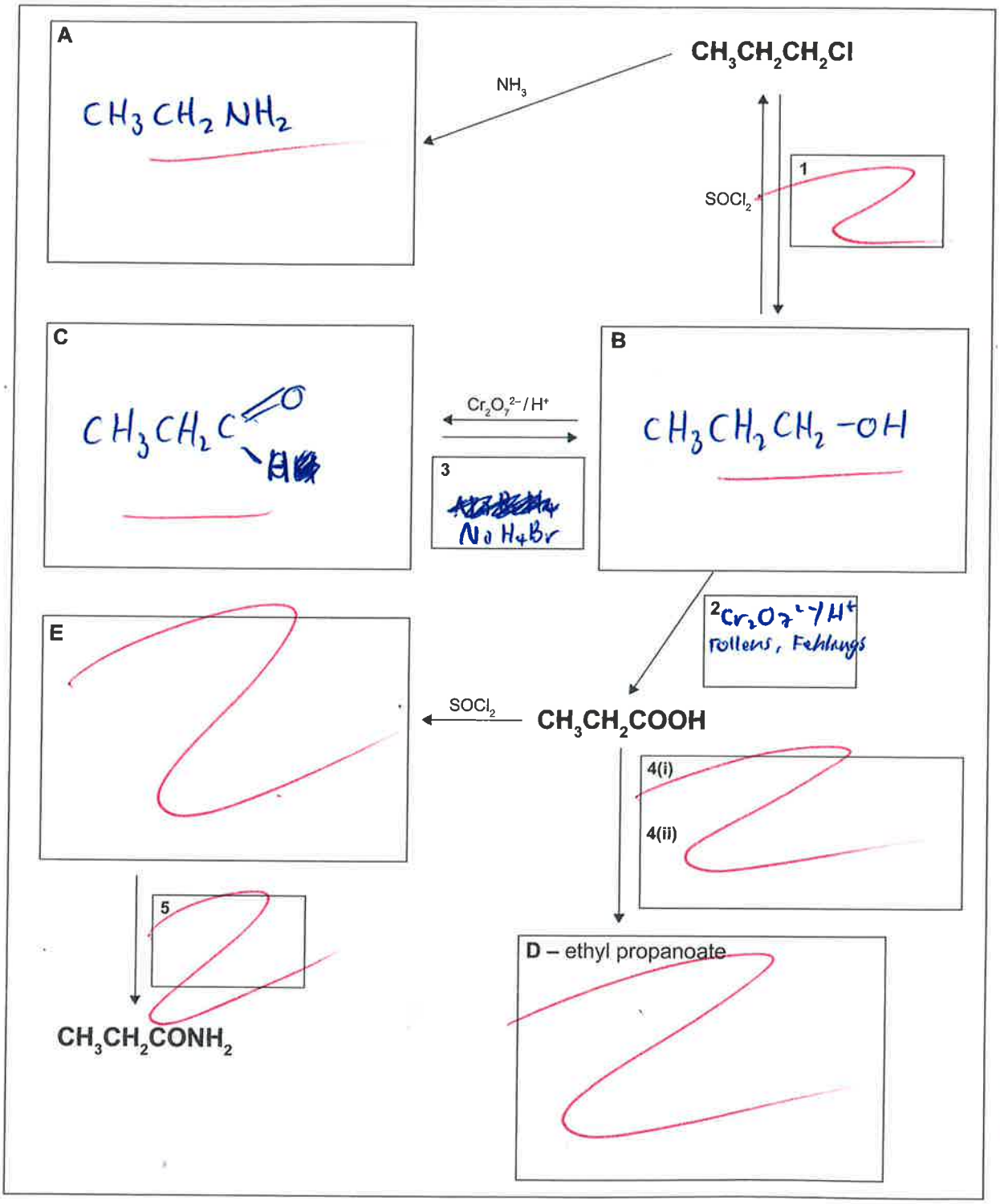


This is a reflux apparatus. The wat

Question Three continues on the following page.

(b) Complete the following reaction scheme by drawing the structural formulae of the organic compounds **A** to **E**, and identifying reagents **1** to **5**.



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Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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$NaBH_4$

Extra paper if required.
Write the question number(s) if applicable.

QUESTION NUMBER

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Grade score 06 – Not Achieved

Q1

(c)(ii) Discussion required

Q2

(c)(i) The amide link and terminal ends were incorrect

(c)(ii) Condensation polymerisation not addition polymerisation

(c)(iii) Sebacoyl chloride reacts vigorously in water

Q3

(a)(ii) Bromine water will change colour from orange/red to colourless via an addition reaction

(a)(iv) Reflux is used to increase the rate of reaction while preventing volatile chemicals from evaporating

(b) Three structural formula correct however, only two reagents.