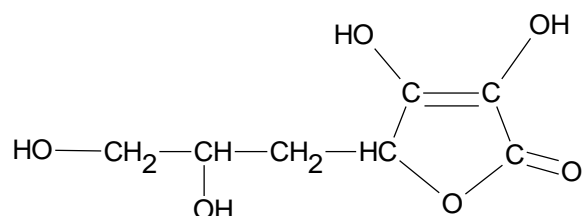


**QUESTION ONE**

The compound ascorbic acid (vitamin C), shown below, is found in many foods and is important in helping the immune system in the human body.



- (a) (i) Name **three** functional groups present in ascorbic acid.

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

- (ii) **Circle** a chiral carbon in the structure of ascorbic acid shown above.

- (b) Compare and contrast the **physical and chemical** properties of the two isomers that exist due to the chiral carbon. Give the name of this type of isomerism in your answer.

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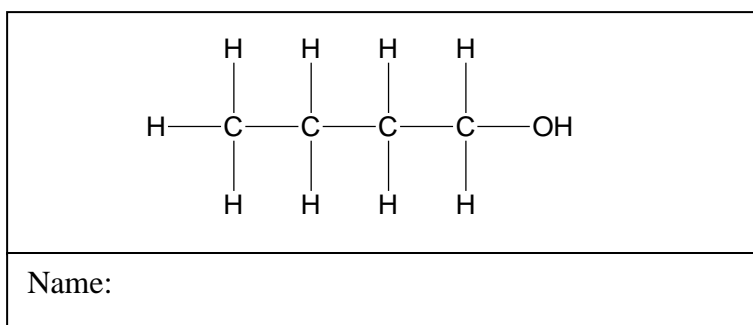


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- (c) (i) Name the compound shown below.



- (ii) Draw two isomers of the compound above that satisfy the requirements given below.

Secondary Alcohol	Tertiary alcohol

- (d) Discuss how you could distinguish between the three alcohols from part (c).

Your explanation should include:

- The reagents used and conditions required
- The expected observations
- Equations showing the reactions occurring

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Assessor's  
use only

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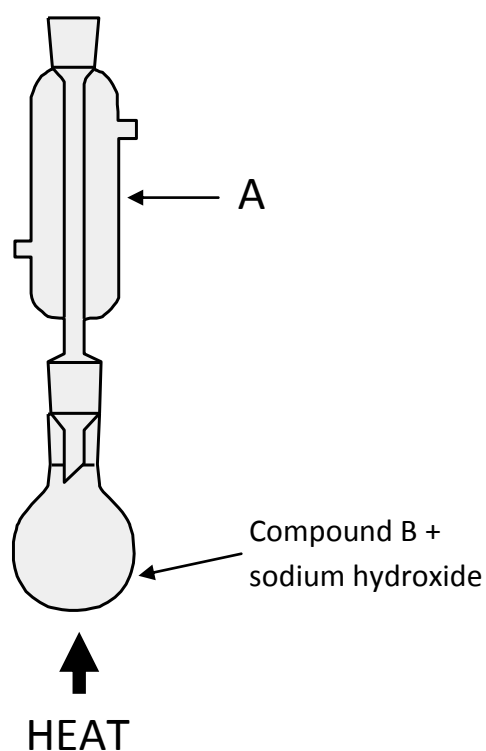
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**QUESTION TWO**

- (a) Draw the structural formula or write the IUPAC systematic name for each of the organic compounds below.

A Butanoyl chloride	B
	$  \begin{array}{ccccccccc}  & \text{H} & & \text{H} & & \text{H} & & \text{Br} & & \text{H} \\  &   & &   & &   & &   & &   \\  \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - \text{H} \\  &   & &   & &   & &   & &   \\  & \text{H} & & \text{H} & & \text{H} & & \text{H} & & \text{H}  \end{array}  $
C 1-aminomethylpropane	D
	$  \begin{array}{ccccccccc}  & \text{H} & & \text{H} & & \text{CH}_3 & & \text{H} & & \text{H} & & \text{O} \\  &   & &   & &   & &   & &   & & // \\  \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\  &   & &   & &   & &   & &   & & \backslash \\  & \text{H} & & \text{H} & & \text{H} & & \text{Cl} & & \text{H} & & \text{H}  \end{array}  $

When compound B above is mixed with aqueous sodium hydroxide and boiled at 71°C for 40 minutes, a reaction occurs. This reaction is carried out using the apparatus below:



- (b) (i) Name the piece of equipment marked 'A' in the diagram on the previous page.

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- (ii) Name the process which uses this apparatus and explain why it is necessary for this reaction.

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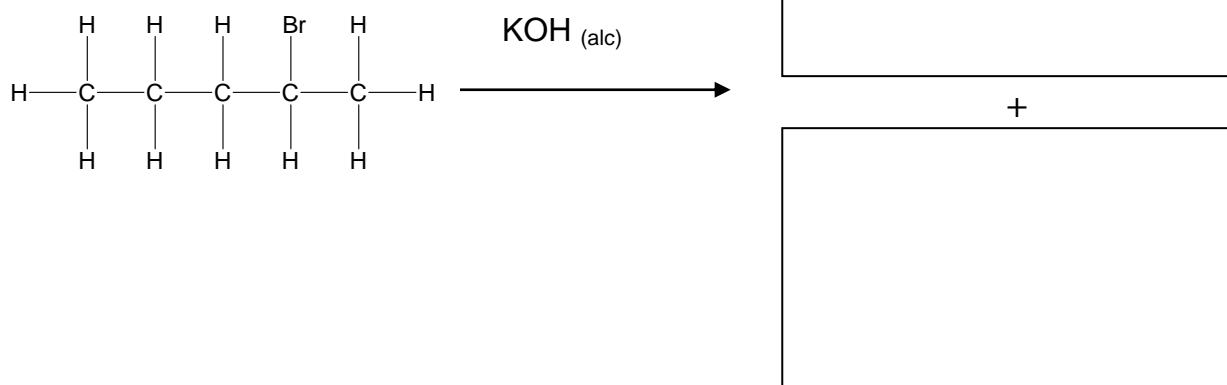
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- (iii) Using structural formulae, write the equation for the reaction taking place between compound B and aqueous sodium hydroxide.

- (c) Compound B will also react with hydroxide ions dissolved in ethanol to produce two organic products. Complete the following equation to show the **two** organic products formed.

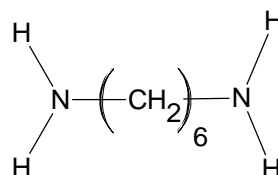
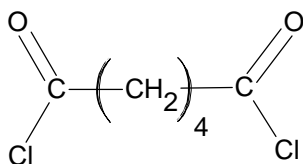




### QUESTION THREE

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Nylon is a condensation polymer made from the following monomers:



- (a) (i) Explain why nylon is known as a 'condensation polymer'.

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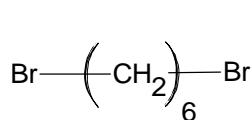


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- (ii) Draw a section of the polymer showing one repeating unit.

The diacyl chloride monomer used in the synthesis of nylon can be made in the laboratory using 1,6-dibromohexane.

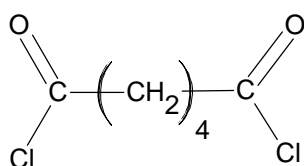
- (b) Complete the reaction scheme below to show how the diacyl chloride can be made from 1,6-dibromohexane.



NaOH (aq)



Reagent



Reagent

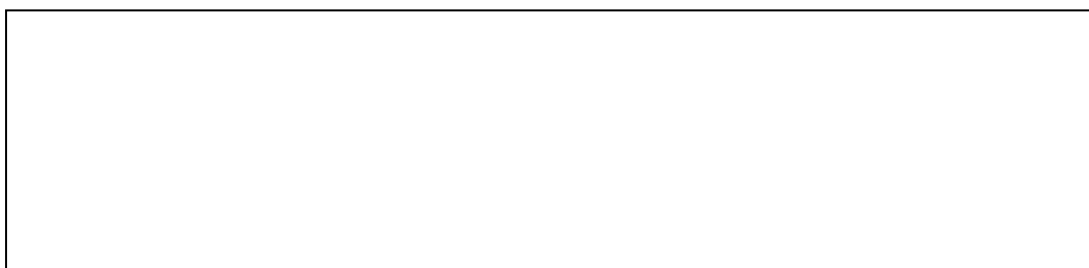
- (c) Given the right conditions, molecules of compound X react in a condensation reaction to form compound Y, a polymer.

Compound X has the molecular formula,  $C_4H_8O_3$  and will react with acidified potassium dichromate solution. It also has a branch chain structure and turns blue litmus red.

- (i) Draw the structure of compound X.



- (ii) Draw a section of the polymer, compound Y, showing at least two repeating units.



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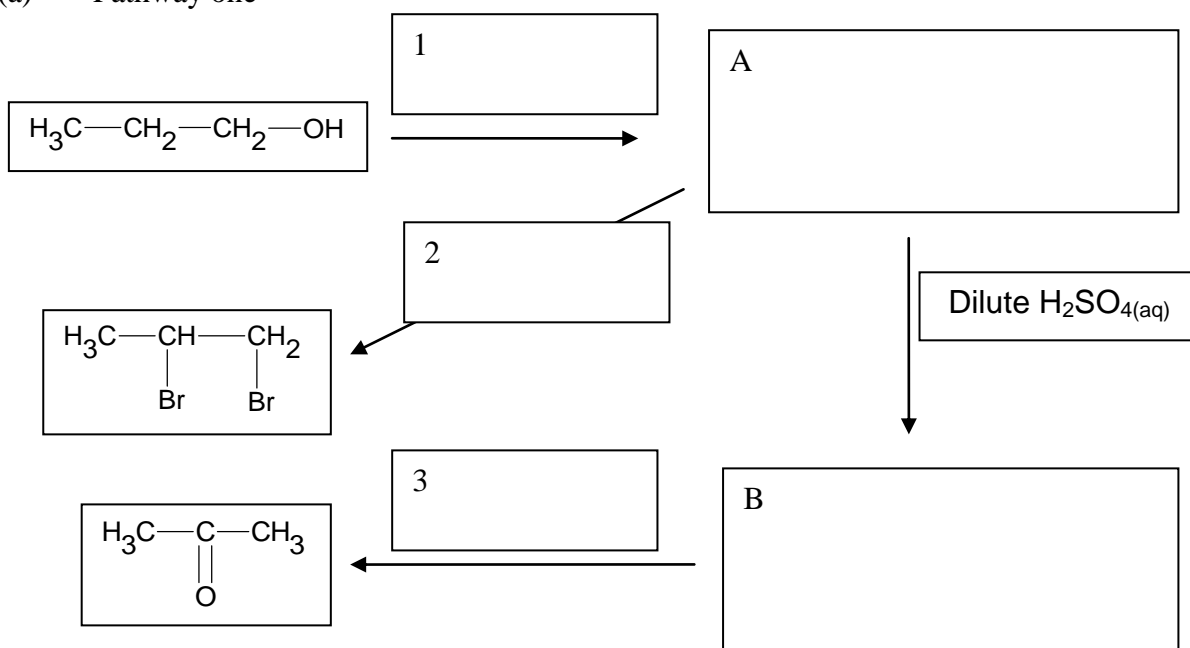


## QUESTION FOUR

Complete the following reaction pathways by drawing structural formulae for products A to E and, in the shaded boxes, identify the reagents 1 to 5 (including any necessary conditions) needed to bring about each transformation.

Assessor's  
use only

(a) Pathway one



(b) Pathway two

