1. The boiling point of butan-1-ol is 118 °C. The boiling point of 2-methylpropan-2-ol is 82 °C.

Why is the boiling point of butan-1-ol higher than that of 2-methylpropan-2-ol?

A butan-1-ol has stronger induced dipole–dipole interactions because it has more electrons

B butan-1-ol has stronger induced dipole–dipole interactions because it has a straight-chain structure

C butan-1-ol can form hydrogen bonds while 2-methylpropan-2-ol cannot

D butan-1-ol is more stable because it is a primary alcohol

Your answer ☐

[1]

2. This question is about alcohols.

(a) Construct an equation for the complete combustion of an unsaturated alcohol with 5 carbon atoms.

..... **[1]**

(b) Many alcohols, including ethanol, are soluble in water.

(i) Explain, with the aid of a diagram, why ethanol is soluble in water.

Include relevant dipoles and lone pairs.

.....

.....

..... **[2]**

(ii) The solubility of hexan-1-ol and hexane-1,6-diol in water is shown below in **Table 19.1**.

Alcohol	Solubility in water / g dm^{-3}
hexan-1-ol	5.9
hexane-1,6-diol	500

Table 19.1

Explain the difference in solubility of hexan-1-ol and hexane-1,6-diol.

.....

.....

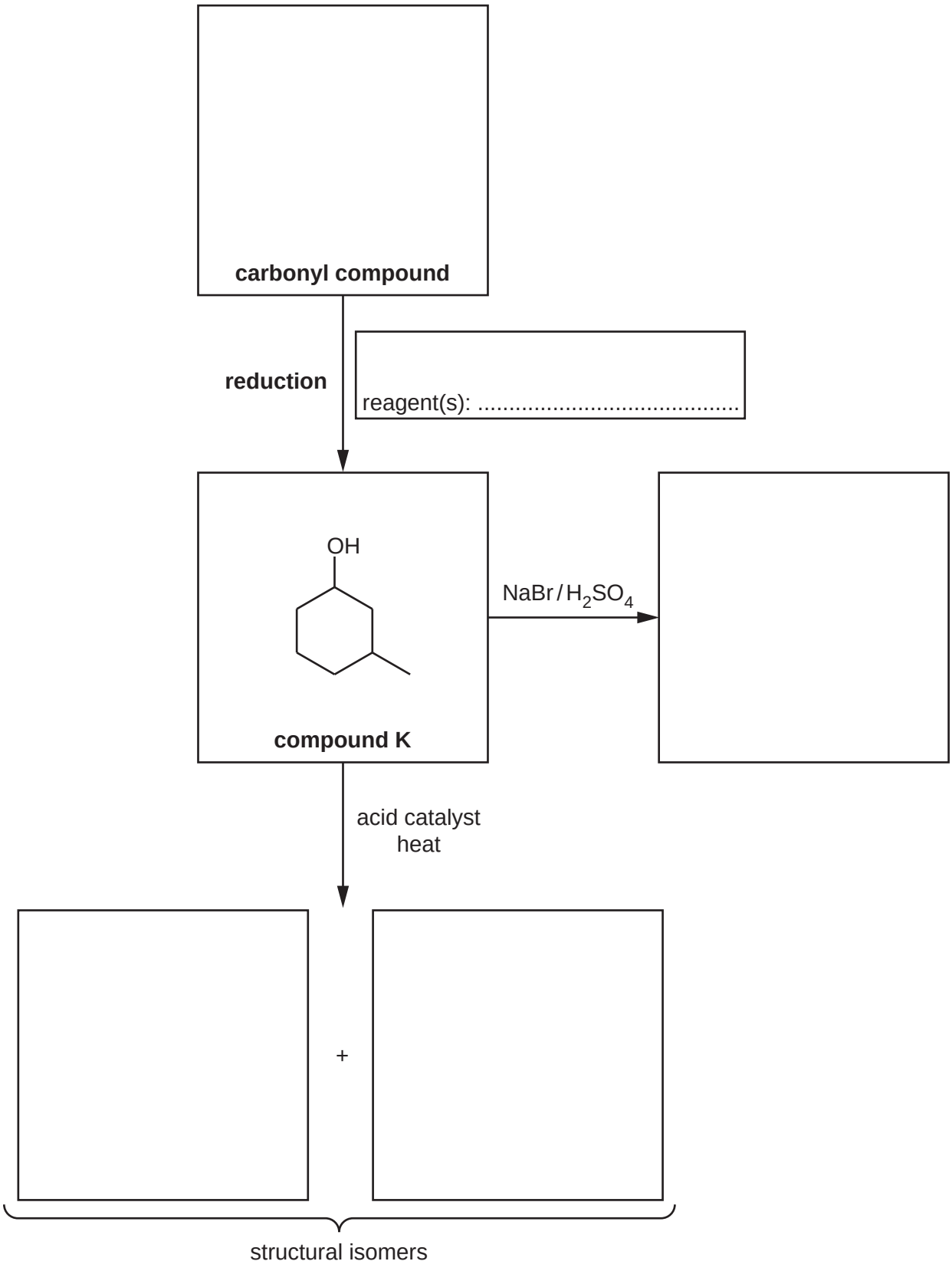
.....

.....

..... **[1]**

(c) Alcohols are important in organic synthesis and can be formed by the reduction of carbonyl compounds.

(i) Complete the flowchart by filling in each box.



[5]

(ii) What is the name of compound **K**?

..... **[1]**

(d) Butan-1-ol can be oxidised to form two different organic products, depending on the reaction conditions used.

Describe both oxidation reactions of butan-1-ol.

For each reaction include

- the structure of the organic product
- a balanced equation
- the essential reaction conditions.

In your equations you may use [O] to represent the oxidising agent.

.....

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.....

..... **[5]**

3. Ethanol can be prepared by different reactions.

Which reaction has the lowest atom economy?

A $C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

B $C_2H_4 + H_2O \rightarrow C_2H_5OH$

C $C_2H_5Br + H_2O \rightarrow C_2H_5OH + HBr$

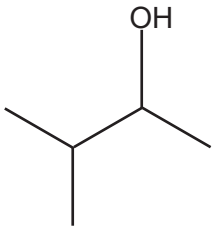
D $CH_3COOC_2H_5 + H_2O \rightarrow C_2H_5OH + CH_3COOH$

Your answer ☐

[1]

4. This question is about reactions of organic compounds containing carbon, hydrogen and oxygen.

(a) A chemist investigates two reactions of alcohol **A**, shown below.



alcohol A

(i) What is the systematic name of alcohol **A**?

..... **[1]**

(ii) What is the structural formula of alcohol **A**?

..... **[1]**

(iii) The chemist heats alcohol **A** with an acid catalyst to form a mixture containing **two** alkenes.

Draw the structures of the **two** alkenes formed in this reaction.

[2]

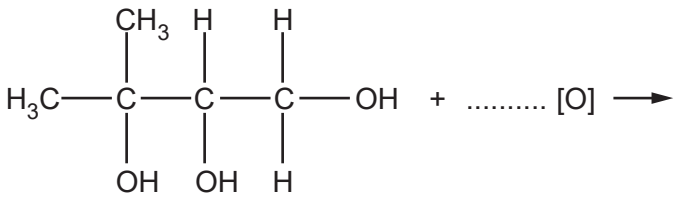
(iv) The chemist heats alcohol **A** with sodium chloride and sulfuric acid.

Construct a balanced equation for this reaction.
Show structures for the organic compounds in your equation.

[2]

(b) Compound **B**, shown below, is refluxed with excess acidified potassium dichromate(VI) to form a single organic product.

Complete the equation for this reaction.

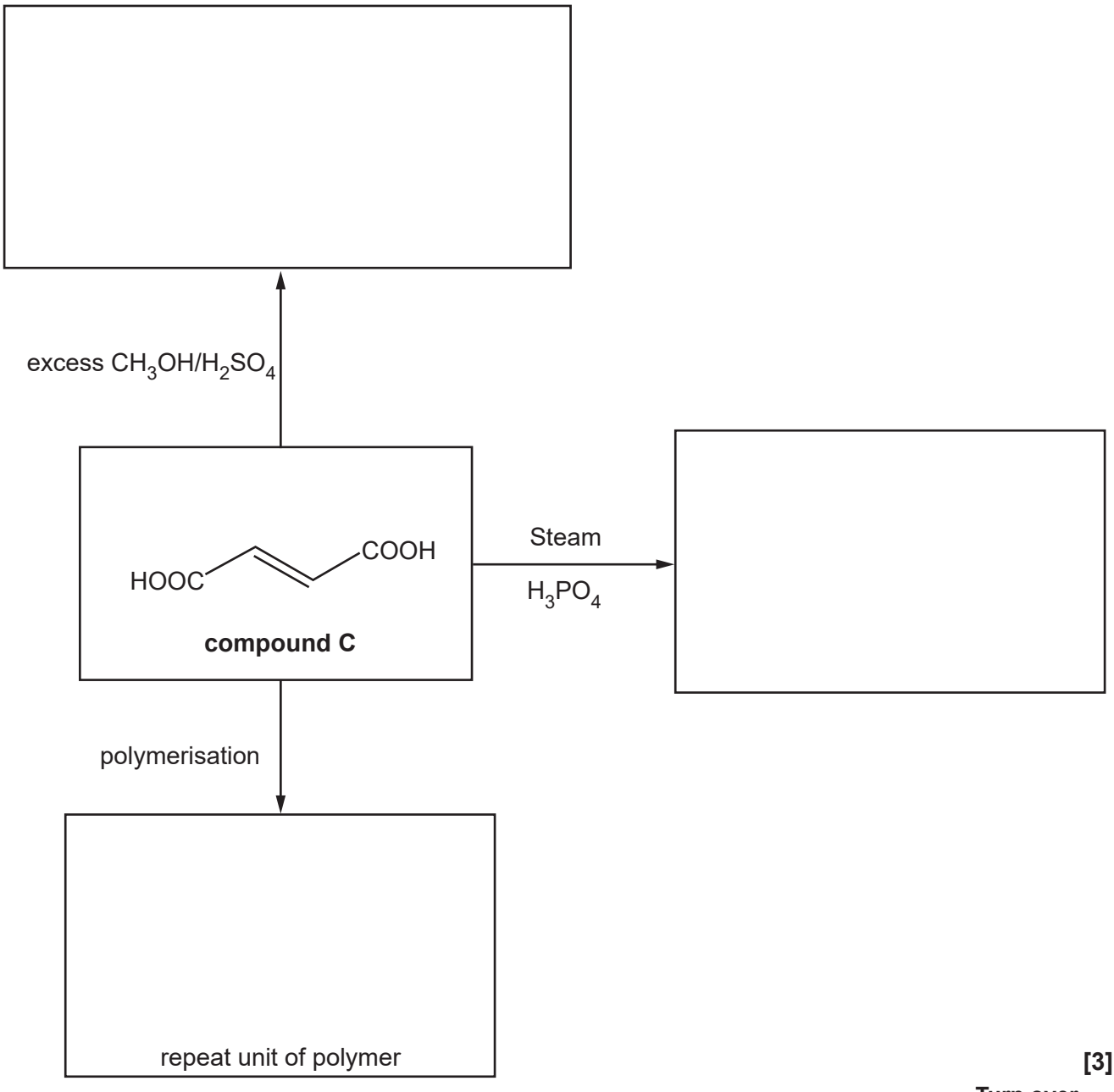


compound B

[2]

(c) The flowchart below shows some reactions of compound **C**.

In the boxes, draw the organic products of these reactions.



[3]

5. Which of these reagent(s) will **not** react with $HOCH_2CH_2CH_2COOH$?

A NaCN in ethanol

B C_2H_5OH in the presence of an acid catalyst

C $(CH_3CO)_2O$

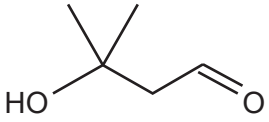
D concentrated H_2SO_4

Your answer ☐

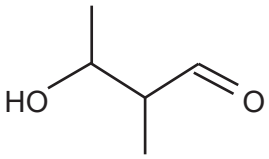
[1]

6. Which compound can be refluxed with acidified potassium dichromate(VI) to form an organic product with molecular formula $C_5H_8O_2$?

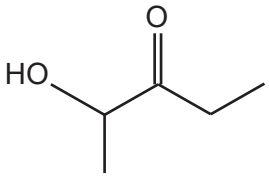
A



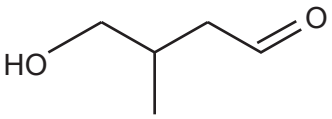
B



C



D



Your answer ☐

[1]

7. Which alcohol reacts with an acid catalyst to form a mixture of stereoisomers?

A 3-methylbutan-2-ol

B pentan-1-ol

C 2-methylhexan-2-ol

D heptan-4-ol

Your answer ☐

[1]

8. Which of the following reactions produce propan-1-ol?

1 The alkaline hydrolysis of 1-chloropropane.

2 The acid hydrolysis of propyl methanoate.

3 The acid hydrolysis of propanenitrile.

A 1, 2 and 3

B Only 1 and 2

C Only 2 and 3

D Only 1

Your answer ☐

[1]

9. Alcohols can be used to prepare organic compounds with different functional groups.

(a) $HO(CH_2)_4OH$ can be oxidised to form $HOOC(CH_2)_2COOH$.

(i) State the reagents and conditions and write an equation for this oxidation.

In the equation, use [O] for the oxidising agent.

Reagents and conditions: .....

.....

Equation:

[3]

(ii) $HOOC(CH_2)_2COOH$ is soluble in water.

Explain, using a labelled diagram, why $HOOC(CH_2)_2COOH$ is soluble in water.

[2]

(b) $HOOC(CH_2)_2COOH$ and $HO(CH_2)_4OH$ react together to form polymer **E**.

(i) Draw **one** repeat unit of polymer **E**.

The functional groups should be clearly displayed.

[2]

(ii) Governments are encouraging the development of biodegradable polymers to reduce dependency on persistent plastic waste derived from fossil fuels.

Polymer **E** is a biodegradable polymer.

Suggest why polymer **E** is able to biodegrade.

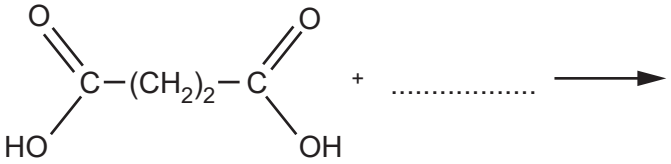
.....

..... **[1]**

(iii) A large yield of polymer **E** can be obtained by reacting a diacyl dichloride with $HO(CH_2)_4OH$.

The diacyl dichloride is prepared from $HOOC(CH_2)_2COOH$.

Complete the equation for the formation of a diacyl dichloride from $HOOC(CH_2)_2COOH$.



[3]