

Alcohols

AS & A Level

Question Paper 3

Level	A Level
Subject	Chemistry
Exam Board	OCR
Module	Core Organic Chemistry
Topic	Alcohols
Paper	AS & A Level
Booklet	Question Paper 3

Time allowed: 53 minutes

Score: /39

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E
>85%	73%	60%	47%	34%	21%

Question 1

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

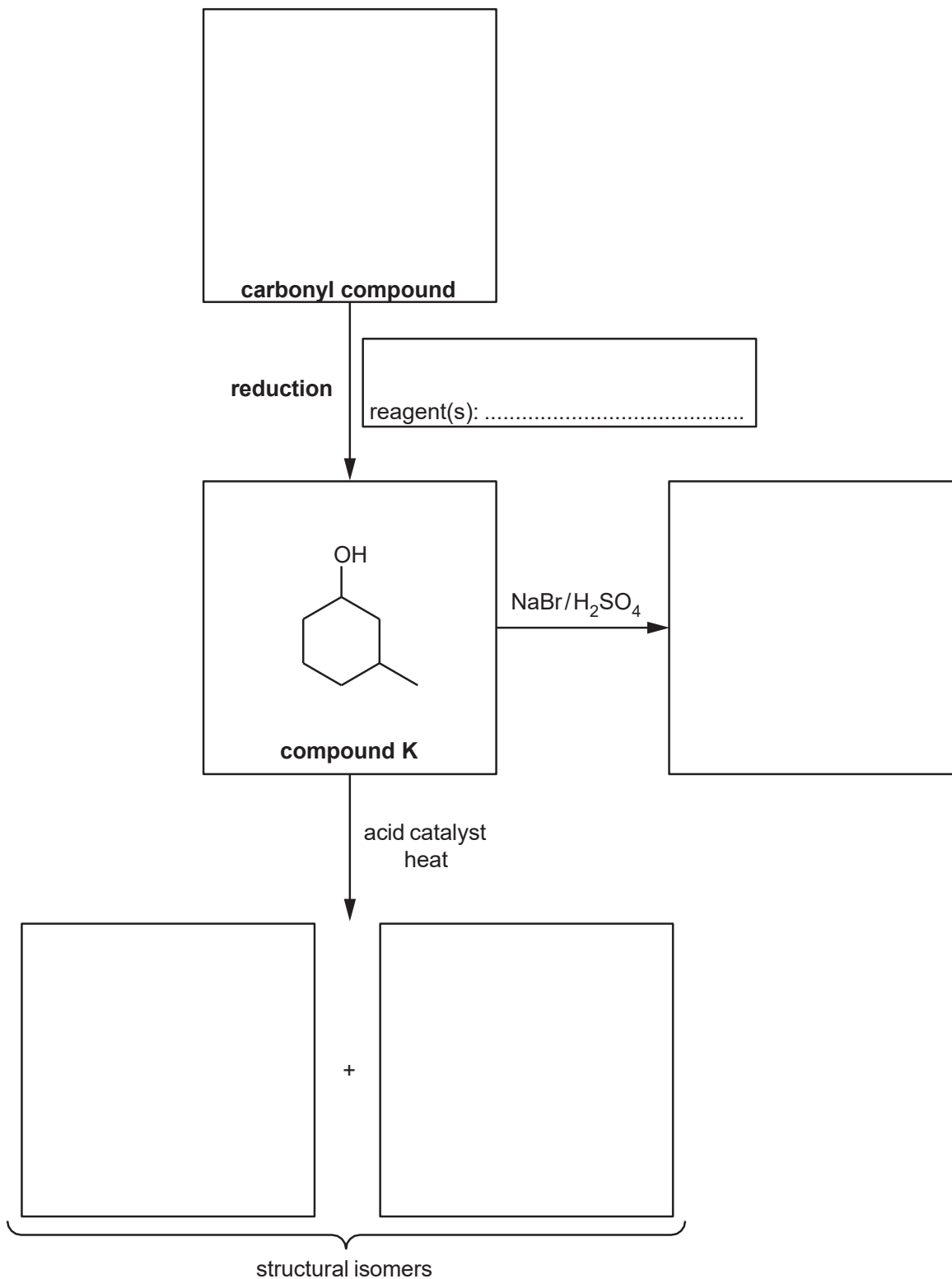
Table 19.1

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.

[5]

(Total 15 marks)

Question 2

The hydroxyl group, -OH , is responsible for many properties of alcohols.

(a) Methanol, CH_3OH , is soluble in water because it has polar bonds.

Pauling electronegativity values for carbon, oxygen and hydrogen are shown below.

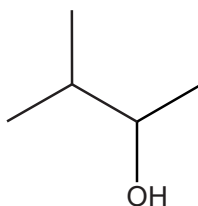
Element	Electronegativity
Carbon	2.5
Oxygen	3.5
Hydrogen	2.1

Use a labelled diagram to explain why methanol is soluble in water.

- Use displayed formulae showing one molecule of methanol and one molecule of water.
- Add partial charges δ^+ and δ^- to show the **two** most polar bonds in a methanol molecule and the polar bonds in a water molecule.
- Show all lone pairs.
- Label the most important intermolecular bond between the molecules.

[2]

(b) Alcohol **C** is analysed using mass spectrometry.



alcohol **C**

(i) Give the systematic name of alcohol **C**.

[1]

(c)* Describe the oxidation reactions of butan-1-ol forming an aldehyde and a carboxylic acid.

Explain, using a diagram, how the aldehyde can be produced in the laboratory by controlling the reaction conditions.

[6]

(Total 9 marks)

Question 3

This question is about the homologous series of alcohols.

(a) What is meant by the term *homologous series*? [2]

(b) Ethanol is used more than any other alcohol. One method of preparing ethanol uses yeast.

Write the equation for this preparation and state the essential conditions. [2]

(c) At room temperature and pressure, the first four members of the alkanes are all gases but the first four alcohols are all liquids.

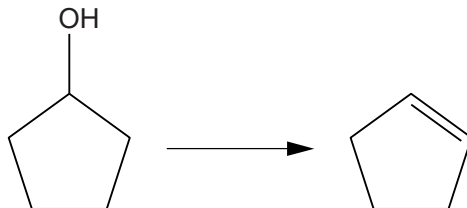
Explain this difference in terms of intermolecular forces. [2]

(d) The boiling points of 2-methylpropan-1-ol and butan-1-ol are shown below.

Alcohol	Boiling point/°C
2-methylpropan-1-ol	108
butan-1-ol	117

Explain why the boiling points are different. [2]

- (e) Alkenes can be prepared from alcohols. Cyclopentene can be prepared from cyclopentanol as shown in the equation below.



A student plans to prepare 5.00 g of cyclopentene from cyclopentanol. The percentage yield of this reaction is 45.0%.

- (i) What is the name of this type of reaction? [1]

- (ii) Calculate the mass of cyclopentanol that the student should use.

Show your working.

[3]

(f) Alcohols can be prepared from halogenoalkanes. 2,2-dimethylpropan-1-ol can be prepared by hydrolysis of a chloroalkane with aqueous sodium hydroxide.

(i) Write the equation for this reaction.

Use structures for the organic compounds.

[1]

(ii) Outline the mechanism for this reaction.

Show curly arrows and relevant dipoles.

[2]

[Total 15 Marks]