



# **A-Level Chemistry**

## **Elimination of Alcohols**

### **Question Paper**

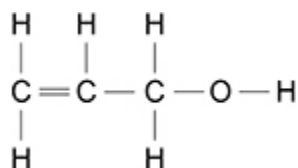
**Time available: 54 minutes**

**Marks available: 50 marks**

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**1.**

Prop-2-en-1-ol is a natural chemical found in garlic. It is also used in the production of plasticisers.



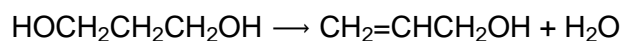
- (a) Prop-2-en-1-ol can be prepared by reacting 3-chloroprop-1-ene with dilute aqueous sodium hydroxide.

Name the mechanism for this reaction.

\_\_\_\_\_

(1)

- (b) Prop-2-en-1-ol can also be formed from HOCH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH in the presence of an acid catalyst.



Name and outline a mechanism for this reaction.

Name of mechanism \_\_\_\_\_

Outline of mechanism

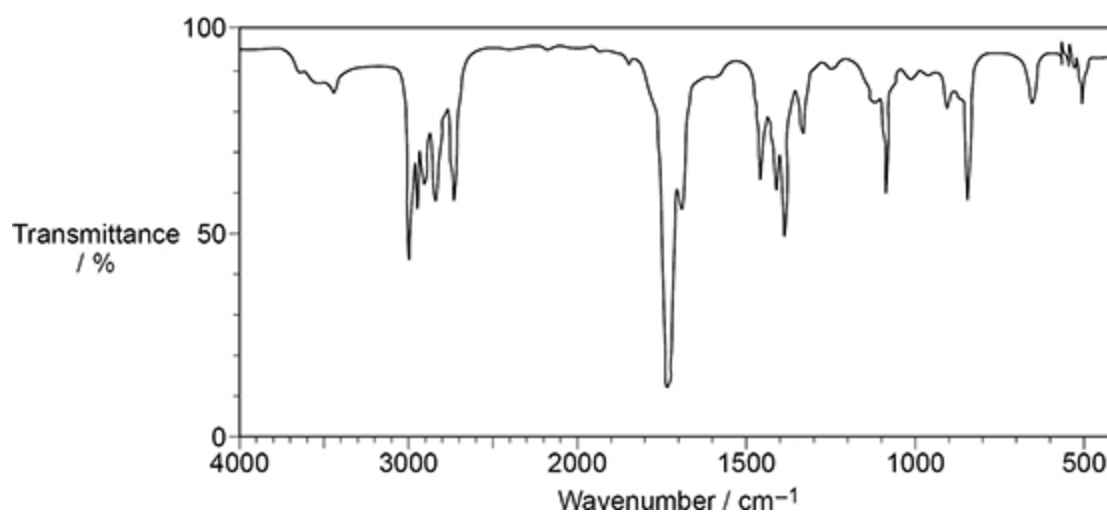
(4)

(c) Prop-2-en-1-ol forms an addition polymer.

Draw the repeating unit of poly(prop-2-en-1-ol).

(1)

(d) The figure below shows the infrared spectrum of a functional group isomer of prop-2-en-1-ol.



This isomer reacts with acidified potassium dichromate(VI) to form a green solution.

Draw the structure of this isomer.

(1)

(Total 7 marks)

**2.**

This question is about pentan-2-ol and pent-1-ene.

- (a) The boiling point of pentan-2-ol is 119 °C  
The boiling point of pent-1-ene is 30 °C

Explain why pentan-2-ol has a higher boiling point than pent-1-ene.

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**(3)**

- (b) Pent-1-ene is formed by the elimination of water from pentan-2-ol.

State the reagent and condition for this reaction.

Outline the mechanism for this reaction.

Reagent \_\_\_\_\_

Condition \_\_\_\_\_

Outline of mechanism

**(5)**

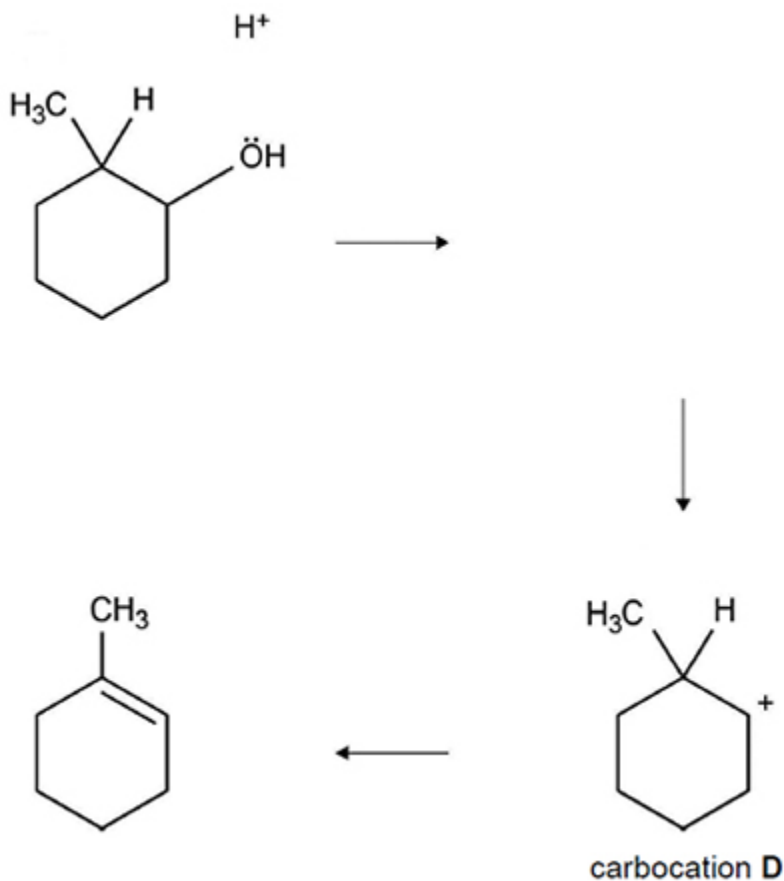
**(Total 8 marks)**

**3.**

Alcohols undergo dehydration in the presence of concentrated phosphoric acid, via a carbocation intermediate, to form alkenes.

(a) Complete the mechanism for the conversion of 2-methylcyclohexanol into 1-methylcyclohexene via carbocation **D** by drawing

- the structure of the missing intermediate
- all necessary curly arrows.

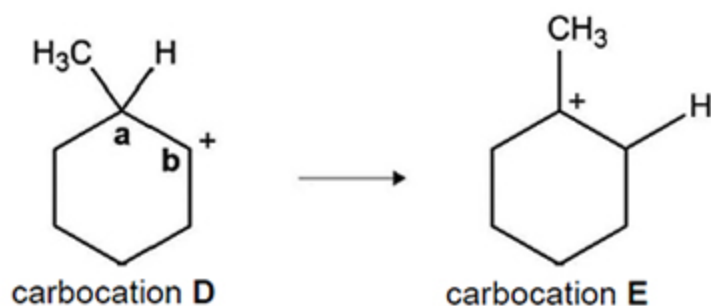


(4)

(b) Draw the structure of a different cyclic alkene formed from carbocation **D**.

(1)

- (c) Carbocation **D** can undergo a type of reaction called a rearrangement to form carbocation **E**. In this reaction, a hydrogen atom and its bonding pair of electrons move from carbon **a** to carbon **b** as shown in the diagram below.



Use your knowledge of carbocations to explain why this rearrangement takes place.

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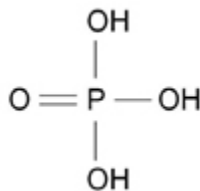
(2)

- (d) As a result of the rearrangement in part (c), a third alkene is formed in this reaction.

Draw the structure of this third alkene.

(1)

- (e) Cyclohexene is prepared by the dehydration of cyclohexanol using concentrated phosphoric acid as a catalyst. The structure of concentrated phosphoric acid is shown.



Identify the factors that influence the boiling points of each of the compounds in this reaction mixture. State how and explain why cyclohexene can be separated from the reaction mixture.

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(6)

(Total 14 marks)

4.

Alcohol **A**  $(\text{CH}_3)_2\text{CHCH}(\text{OH})\text{CH}_3$  undergoes reactions separately with acidified potassium dichromate(VI) and with concentrated sulfuric acid.

- (a) Deduce the IUPAC name for alcohol **A**.

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(1)

- (b) Draw the structure of the organic product, **B**, formed when **A** is oxidised in the reaction with acidified potassium dichromate(VI).

(1)

- (c) Two isomeric alkenes, **C** and **D**, are formed when **A** is dehydrated in the reaction with concentrated sulfuric acid.

Name the mechanism for this dehydration reaction.

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(1)

- (d) Draw the structure of each isomer.

Isomer **C**

Isomer **D**

(2)

- (e) Name the type of structural isomerism shown by **C** and **D**.

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(1)

- (f) List alcohol **A**, product **B** and isomer **C** in order of increasing boiling point.

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(1)

- (g) Draw the structure of the isomer of **A** that is **not** oxidised by acidified potassium dichromate(VI).

(1)



- (h) Draw the structure of the isomer of **A** that **cannot** be dehydrated to form an alkene by reaction with concentrated sulfuric acid.

(1)

(Total 9 marks)

5.

- (a) One of the isomers in part (a) is resistant to oxidation by acidified potassium dichromate(VI).

- (i) Identify this isomer.

\_\_\_\_\_

- (ii) This isomer can be dehydrated. Give a suitable dehydrating agent and write an equation for this dehydration reaction.

*Dehydrating agent* \_\_\_\_\_

*Equation* \_\_\_\_\_

(3)

- (b) (i) Identify the isomer in part (a) which can be oxidised to a ketone. Give the structure of the ketone formed.

*Isomer* \_\_\_\_\_

*Structure of the ketone*

- (ii) Identify **one** of the isomers in part (a) which can be oxidised to an aldehyde. Give the structure of the aldehyde formed.

*Isomer* \_\_\_\_\_

*Structure of the aldehyde*

- (iii) Give a reagent that can be used in a test to distinguish between a ketone and an aldehyde. State what you would observe in the test.

*Reagent* \_\_\_\_\_

*Observation with ketone* \_\_\_\_\_

\_\_\_\_\_

*Observation with aldehyde* \_\_\_\_\_

\_\_\_\_\_

**(7)**

- (c) Butan-1-ol can be oxidised to form a carboxylic acid. Using [O] to represent the oxidising agent, write an equation for this reaction and name the product.

*Equation* \_\_\_\_\_

*Name of product* \_\_\_\_\_

**(2)**

**(Total 12 marks)**