



# **A-Level Chemistry**

## **Alkenes Structure**

### **Question Paper**

**Time available: 53 minutes**

**Marks available: 53 marks**

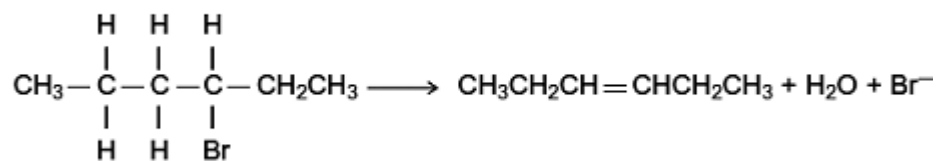
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**1.**

Alkenes are useful intermediates in the synthesis of organic compounds.

- (a) (i) Complete the elimination mechanism by drawing appropriate curly arrows.

$\text{HO}^-$ :



3-bromohexane

hex-3-ene

(3)

- (ii) Draw structures for the E and Z stereoisomers of hex-3-ene.

E isomer of hex-3-ene

Z isomer of hex-3-ene

(2)

- (iii) State the meaning of the term *stereoisomers*.

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(2)

- (b) The equation for the first reaction in the conversion of hex-3-ene into hexan-3-ol is shown below.



Outline a mechanism for this reaction.

(4)

(Total 11 marks)

2.

It is possible to convert but-1-ene into its structural isomer but-2-ene.

- (a) State the type of structural isomerism shown by but-1-ene and but-2-ene.

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(1)

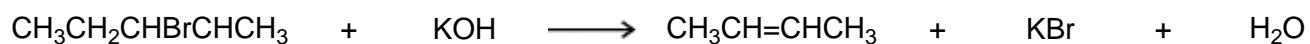
- (b) The first stage in this conversion involves the reaction of hydrogen bromide with but-1-ene.



Outline a mechanism for this reaction.

(4)

(c) The second stage is to convert 2-bromobutane into but-2-ene.



Outline a mechanism for this reaction.

(3)

(Total 8 marks)

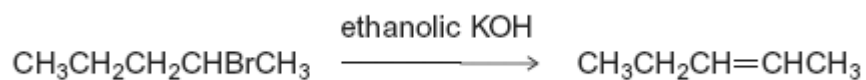
3.

Organic reaction mechanisms help chemists to understand how the reactions of organic compounds occur.

The following conversions illustrate a number of different types of reaction mechanism.

(a) When 2-bromopentane reacts with ethanolic KOH, two structurally isomeric alkenes are formed.

(i) Name and outline a mechanism for the conversion of 2-bromopentane into pent-2-ene as shown below.

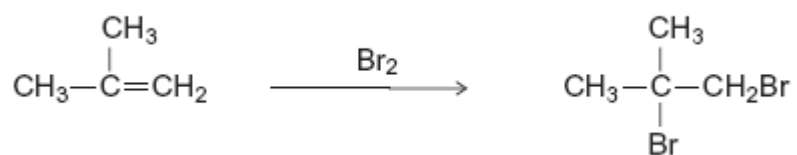


(4)

- (ii) Draw the structure of the other structurally isomeric alkene produced when 2-bromopentane reacts with ethanolic KOH.

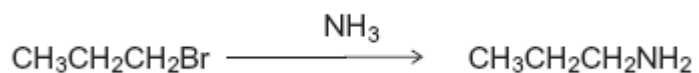
(1)

- (b) Name and outline a mechanism for the following conversion.



(5)

(c) Name and outline a mechanism for the following conversion.



(5)

(Total 15 marks)

4.

The reaction of bromine with an alkene is used in a test to show that the alkene is unsaturated.

(a) State what is meant by the term *unsaturated* as applied to an alkene.

\_\_\_\_\_

(1)

(b) Name and outline a mechanism for the reaction of bromine with but-2-ene.

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

Mechanism

(5)

(c) But-2-ene can exist as a pair of stereoisomers.

(i) State what is meant by the term *stereoisomers*.

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(2)

(ii) Draw the structure of (*E*)-but-2-ene.

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(1)

(Total 9 marks)

5.

(a) Compounds with double bonds between carbon atoms can exhibit geometrical isomerism.

(i) Draw structures for the two geometrical isomers of 1,2-dichloroethene.

*Isomer 1*

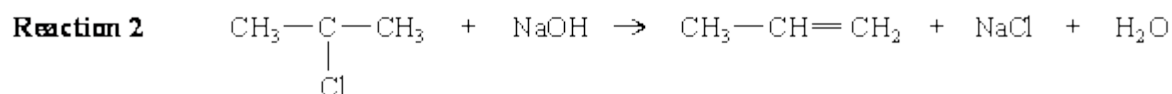
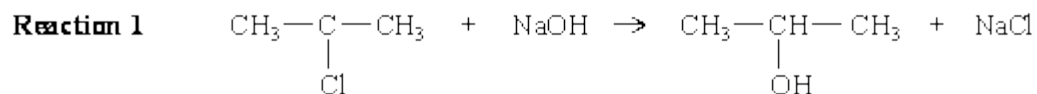
*Isomer 2*

(ii) What feature of the double bond prevents isomer 1 from changing into isomer 2?

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(3)

(b) When 2-chloropropane reacts with sodium hydroxide, two different reactions occur. Each reaction produces a different organic product.



- (i) Outline a mechanism for **Reaction 1** and state the role of the hydroxide ion in this reaction.

*Mechanism*

*Role of the hydroxide ion* \_\_\_\_\_

- (ii) Outline a mechanism for **Reaction 2** and state the role of the hydroxide ion in this reaction.

*Mechanism*

*Role of the hydroxide ion* \_\_\_\_\_

**(7)**

**(Total 10 marks)**