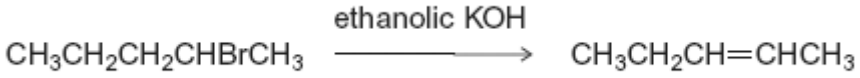
Q1. Organic reaction mechanisms help chemists to understand how the reactions of organic compounds occur.
The following conversions illustrate a number of different types of reaction mechanism.

(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.

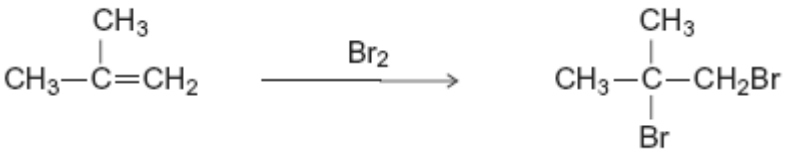


(4)

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

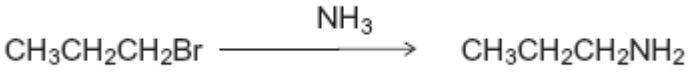
(1)

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

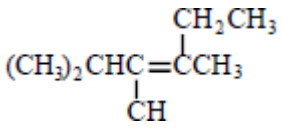


(5)

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



(5)
(Total 15 marks)

Q2. The correct systematic name for  is

A 2-ethyl-3,4-dimethylpent-2-ene

B 4-ethyl-2,3-dimethylpent-3-ene

C 2,3,4-trirnethylhex-3-ene

D 3,4,5-trimethylhex-3-ene

(Total 1 mark)

Q3. (a) Compounds with double bonds between carbon atoms can exhibit geometrical isomerism.

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

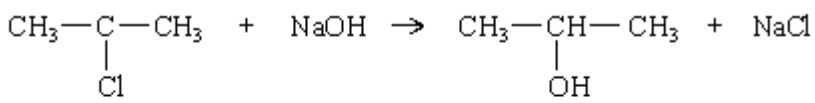
Isomer 1 *Isomer 2*

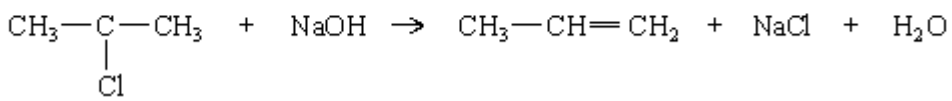
(ii) What feature of the double bond prevents isomer 1 from changing into isomer 2?

.....

(3)

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

Reaction 1 

Reaction 2 

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

this reaction.

Mechanism

Role of the hydroxide ion .....

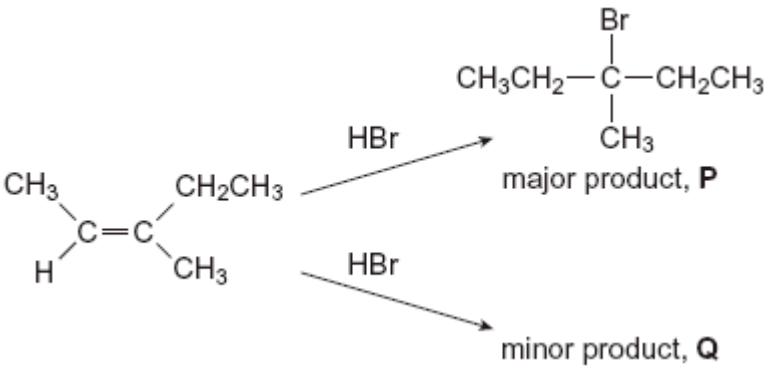
(ii) Outline a mechanism for **Reaction 2** and state the role of the hydroxide ion in this reaction.

Mechanism

Role of the hydroxide ion .....

(7)
(Total 10 marks)

Q4. The alkene (Z)-3-methylpent-2-ene reacts with hydrogen bromide as shown below.



(a) (i) Name the major product **P**.

.....

(1)

(ii) Name the mechanism for these reactions.

.....

(1)

(iii) Draw the displayed formula for the minor product **Q** and state the type of structural isomerism shown by **P** and **Q**.

Displayed formula for **Q**

Type of structural isomerism .....

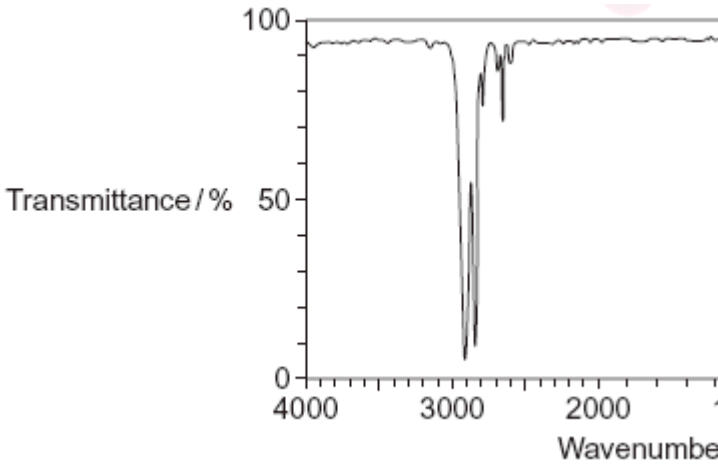
(2)

(iv) Draw the structure of the (E)-stereoisomer of 3-methylpent-2-ene.

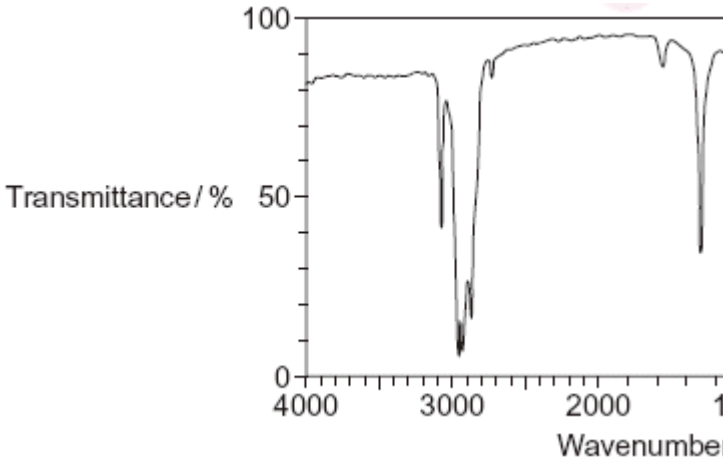
(1)

(b) The infrared spectra of two compounds **R** and **S** are shown below. **R** and **S** have the molecular formula C_6H_{12} and are structural isomers of 3-methylpent-2-ene. **R** is an unsaturated hydrocarbon and **S** is a saturated hydrocarbon.

Spectrum **1**



Spectrum **2**



(i) Identify the infrared Spectrum **1** or **2** that represents compound **R**.
Use information from the infrared spectra to give **one** reason for your answer.
You may find it helpful to refer to **Table 1** on the Data Sheet.

R is represented by Spectrum .....

Reason .....

.....

(2)

(ii) State the type of structural isomerism shown by **R** and **S**.

.....

(1)

(iii) Name **one** possible compound which could be **S**.

.....

(1)
(Total 9 marks)

Q5. 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*.

.....

.....

.....

(2)

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

.....

(1)
(Total 9 marks)