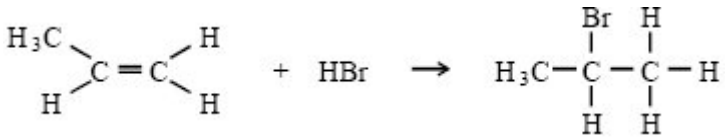
Q1. Organic reaction mechanisms help to develop an understanding of how and why reactions occur.

(a) Propene reacts with hydrogen bromide by an electrophilic addition mechanism forming 2-bromopropane as the major product.

The equation for this reaction is shown below.



(i) Outline the mechanism for this reaction, showing the structure of the intermediate carbocation formed.

(ii) Give the structure of the alternative carbocation which could be formed in the reaction between propene and hydrogen bromide.

(5)

(b) A substitution reaction occurs when 2-bromopropane reacts with aqueous sodium hydroxide.

(i) Draw the structure of the organic product of this reaction and give its name.

Structure

Name .....

(ii) Name and outline the mechanism for this reaction.

Name of mechanism .....

Mechanism

(5)

(c) Under different conditions, 2-bromopropane reacts with sodium hydroxide to produce propene.

(i) Name the mechanism for this reaction

.....

(ii) State the role of sodium hydroxide in this reaction

.....

(2)
(Total 12 marks)

Q2. (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

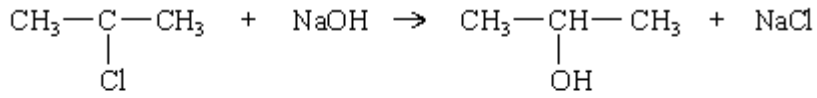
2?

.....

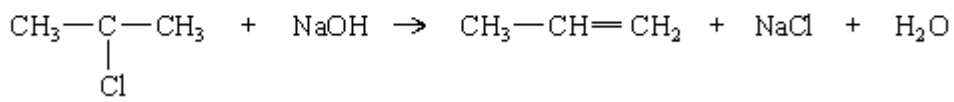
(3)

(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 .....

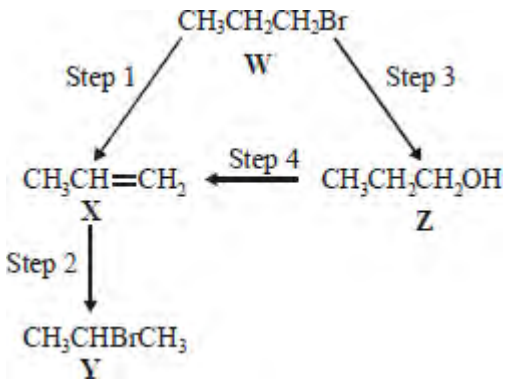
(ii) Outline a mechanism for **Reaction 2** and state the role of the hydroxide ion in this reaction.

Mechanism

Role of the hydroxide ion .....

(7)
(Total 10 marks)

Q3. For this question refer to the reaction scheme below.



Which one of the following reagents would **not** bring about the reaction indicated?

A Step 1 : alcoholic KOH

B Step 2 : aqueous Br_2

C Step 3 : aqueous NaOH

C Step 4 : concentrated H_2SO_4

(Total 1 mark)

Q4. Consider the following reaction in which an alkene is formed from a haloalkane.

$$CH_3CHBrCH_2CH_3 + KOH \xrightarrow[\text{ethanol solvent}]{\text{heat}} \underset{\text{but-2-ene}}{CH_3CH=CHCH_3} + KBr + H_2O$$

(a) Name the haloalkane used in this reaction.

.....

(1)

(b) Name and outline a mechanism for this reaction.

Name of mechanism .....

Mechanism

(4)

(c) Another alkene, which is a structural isomer of but-2-ene, is also formed during this reaction.

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

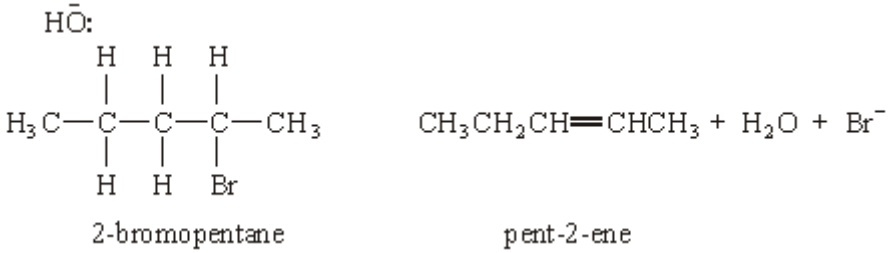
.....

.....

(ii) Draw the structure of this other alkene.

(2)
(Total 7 marks)

Q5. (a) Complete the mechanism below by drawing appropriate curly arrows.



(3)

(b) Draw and name the geometrical E-Z isomers of pent-2-ene.

Isomer 1 *Isomer 2*

Name .....…..... *Name* .....…..... **(2)**

(c) Pent-1-ene reacts with hydrogen bromide to produce 2-bromopentane as the major product.

(i) Outline the mechanism for this reaction.

(ii) Identify the minor product formed in this reaction.

.....

(iii) Explain why 2-bromopentane is the major product of this reaction.

.....

.....

.....

(7)
(Total 12 marks)

Q6. How many different alkenes are formed when 2-bromo-2-methylbutane reacts with ethanolic potassium hydroxide?

A 2

B 3

C 4

D 5

(Total 1 mark)

Q7. (a) Name and outline a mechanism for the reaction of 2-bromo-2-methylpropane with ethanolic potassium hydroxide to form the alkene 2-methylpropene, $(CH_3)_2C=CH_2$

Name of mechanism .....

Mechanism

(4)

(b) Two stereoisomers of but-2-ene are formed when 2-bromobutane reacts with ethanolic potassium hydroxide.

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

.....

.....

(ii) Draw the structures and give the names of the **two** stereoisomers of but-2-ene.

Stereoisomer 1 *Stereoisomer 2*

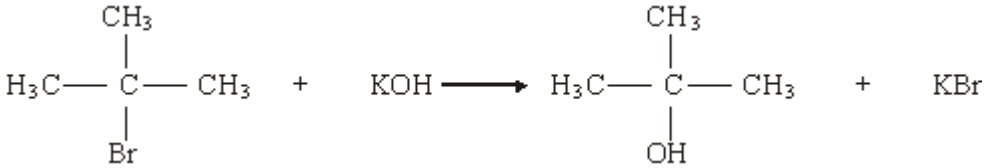
Name ..... *Name* .....

(iii) Name this type of stereoisomerism.

.....

(5)

(c) When 2-bromo-2-methylpropane reacts with aqueous potassium hydroxide, 2-methylpropan-2-ol is formed as shown by the following equation.



State the role of the hydroxide ions in this reaction.

.....

(1)

(d) Write an equation for the reaction that occurs when $CH_3CH_2CH_2CH_2Br$ reacts with an excess of ammonia. Name the organic product of this reaction.

Equation .....

Name of product .....

(3)
(Total 13 marks)