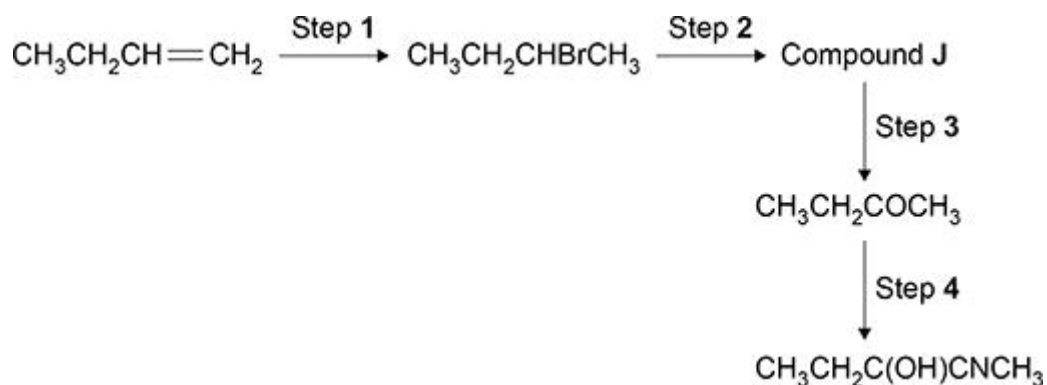


Q1.

This question is about an organic synthesis.



- (a) Name the mechanism in Step 1.

State the reagent(s) used for Step 1.

Name of mechanism _____

Reagent(s) _____

(2)

- (b) Identify compound J.

State the reagent(s) and conditions needed for Step 2.

Compound J _____

Reagent(s) and conditions _____

(2)

- (c) State the reagent(s) used for Step 4.

Outline the mechanism for Step 4.

Reagent(s) _____

Mechanism

(5)

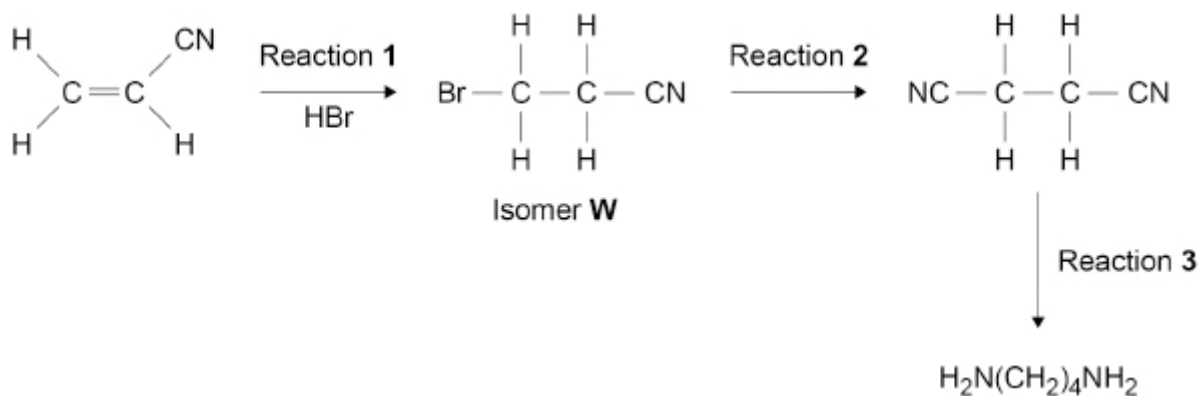
- (d) Explain why Step 4 produces a racemic mixture.

(3)

(Total 12 marks)

Q2.

Acrylonitrile, $\text{H}_2\text{C}=\text{CHCN}$, can be used as a starting material for the synthesis of butane-1,4-diamine, as shown in this reaction scheme.



- (a) Use IUPAC rules to name isomer **W**.

(1)

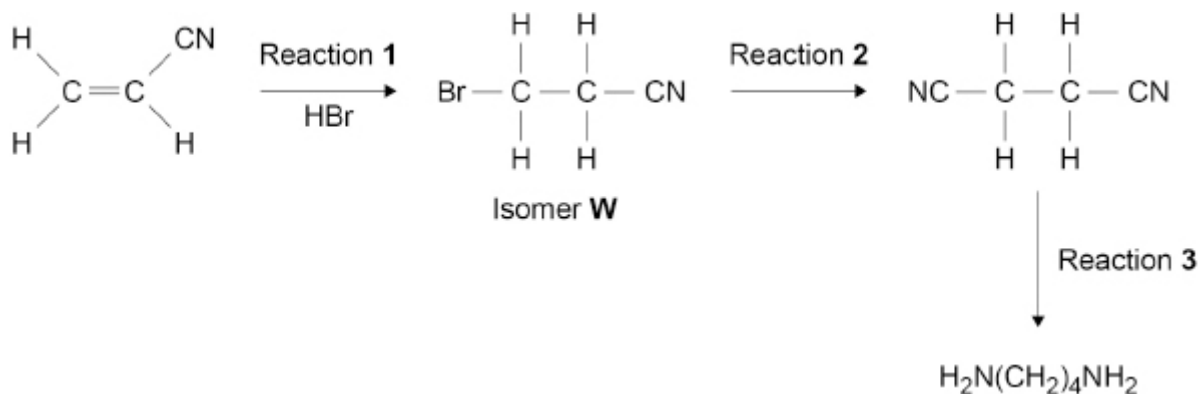
- (b) Reaction **1** produces a mixture of **W** and two other isomers.

Draw the structures of the two other isomers.

Explain, by considering the mechanism of this reaction, why all three isomers are formed.

[illegible]

The reaction scheme is repeated here.



- (c) Identify the reagent that is warmed with isomer **W** in reaction 2.

State the other reaction condition needed.

Reagent _____

Condition _____

(2)

- (d) State the reagent and reaction conditions needed for reaction 3.

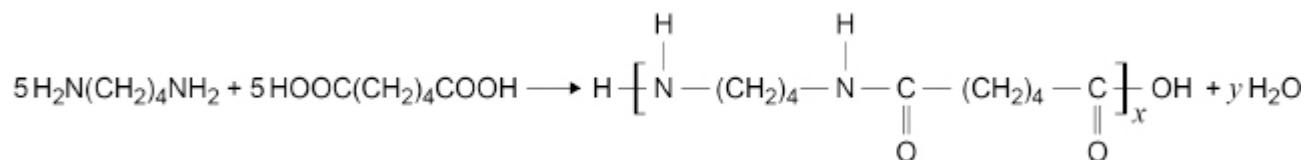
Give an equation for reaction 3.

Reagent and conditions _____

Equation

(2)

- (e) An incomplete equation for the formation of nylon 4,6 from five molecules of butane-1,4-diamine and five molecules of hexanedioic acid is shown.

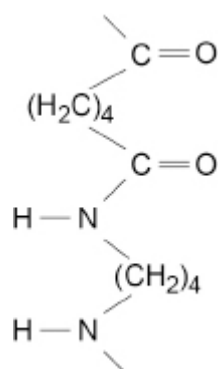


Deduce the values of x and y in this equation.

x _____ y _____

(2)

- (f) The figure below shows a section of the nylon 4,6 polymer molecule.



Draw, on the figure above, another section of nylon 4,6 polymer showing two hydrogen bonds between the two sections.

Draw, on the figure above, another section of nylon 4,6 polymer showing two hydrogen bonds between the two sections.

(2)

(Total 15 marks)