Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Q1.

This question is about reactions of halogenoalkanes with hydroxide ions.

(a) Outline the mechanism for the nucleophilic substitution reaction of 1-bromobutane with sodium hydroxide.

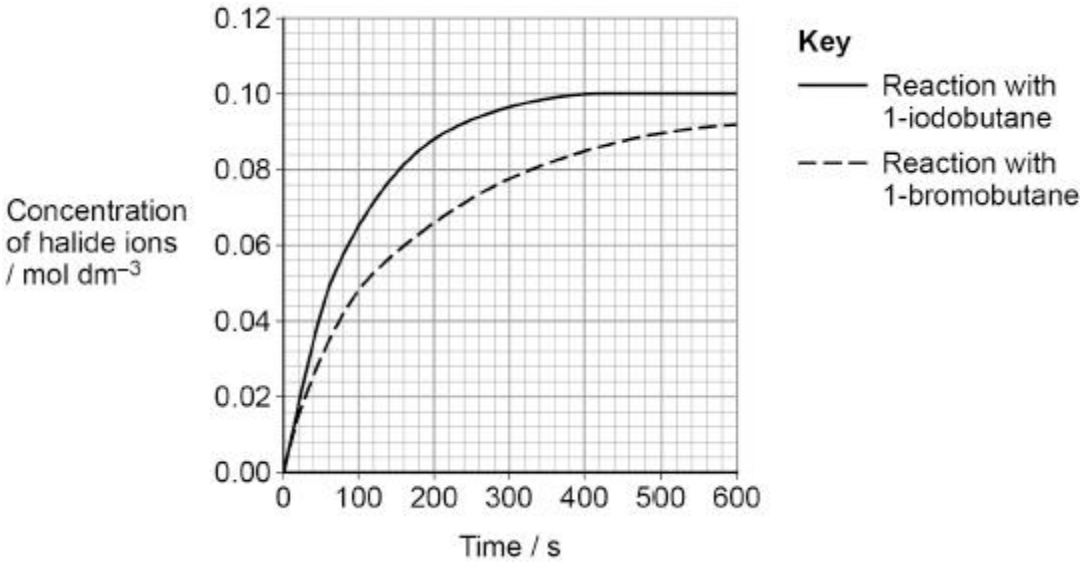
(2)

A student investigated the rate of nucleophilic substitution of halogenoalkanes with hydroxide ions.

Identical concentrations of 1-bromobutane and 1-iodobutane were reacted separately with sodium hydroxide solution under the same conditions.

The concentration of halide ions was monitored during each experiment.

The graph below shows the student's results.



(b) State how the graph shows that the rate of reaction of 1-iodobutane is faster than the rate of reaction of 1-bromobutane.

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State why the rates are different.

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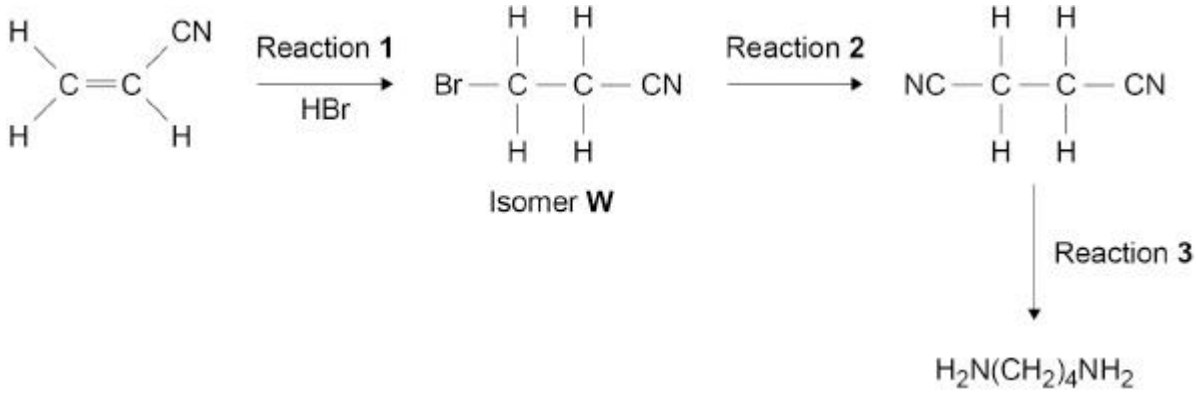
(2)

(Total 4 marks)

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Q2.

Acrylonitrile, $H_2C=CHCN$, 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.

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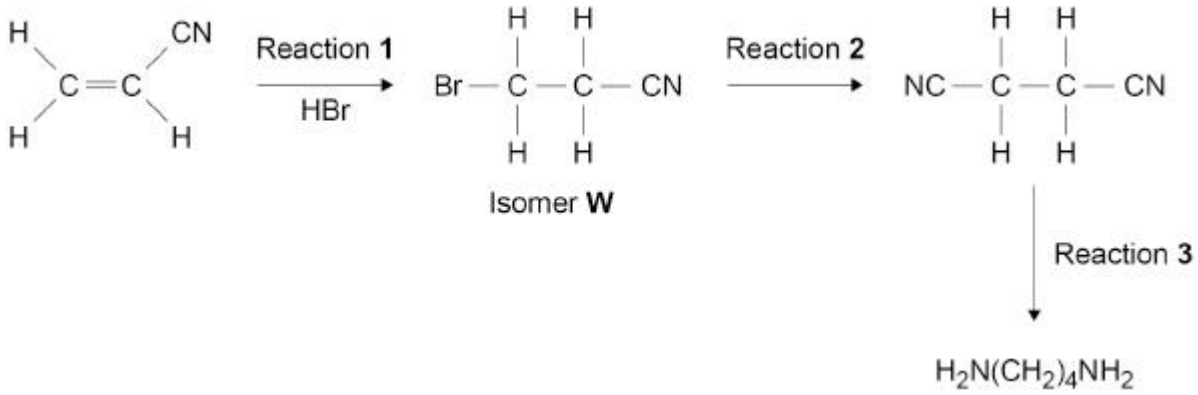
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(6)

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**.

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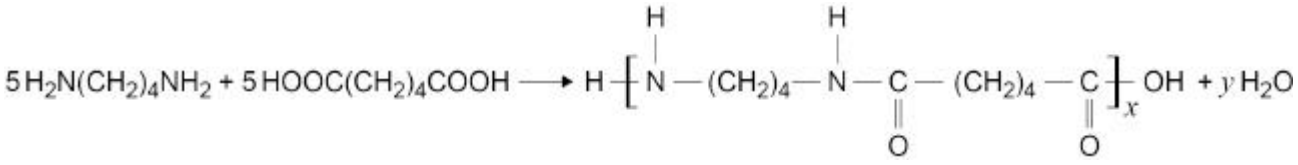
Reagent and conditions _____

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.

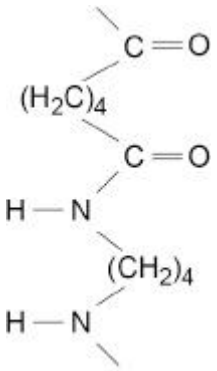


Deduce the values of x and y in this equation.

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)

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