

Edexcel International Chemistry A Level CP5 - Rate of Hydrolysis of Halogenoalkanes

Flashcards

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What is the name of the mechanism for the hydrolysis of halogenoalkanes?



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Nucleophilic substitution



Why can halogenoalkanes undergo nucleophilic substitution reactions?



Why can halogenoalkanes undergo nucleophilic substitution reactions?

Because the carbon-halogen bond is polar (there is a large difference between the electronegativities of the carbon and halogen atoms)



What is the nucleophile used in the hydrolysis of halogenoalkanes?



What is the nucleophile used in the hydrolysis of halogenoalkanes?

Water



Why can water act as a nucleophile?



Why can water act as a nucleophile?

Because there are 2 lone pairs of electrons on each oxygen atom



Name two variables that affect the rate of hydrolysis of halogenoalkanes



Name two variables that affect the rate of hydrolysis of halogenoalkanes

- The halogen atom present (Cl, Br or I)
- The type of halogenoalkane (primary, secondary or tertiary)



What safety precautions must be taken when investigating the rate of hydrolysis of different halogenoalkanes?



What safety precautions must be taken when investigating the rate of hydrolysis of different halogenoalkanes?

- Wear eye protection
- Halogenoalkanes are flammable and harmful so keep away from flames
- Ethanol is flammable so keep away from flames
- Silver nitrate is corrosive so avoid contact with skin
- Hot water can cause burns so avoid contact with skin



Describe an experiment to investigate the hydrolysis of halogenoalkanes



Describe an experiment to investigate the hydrolysis of halogenoalkanes

1. Fill three test tubes with 5 cm^3 of ethanol and add 4 drops of a haloalkane to each one (e.g. 1-chlorobutane, 1-bromobutane and 1-iodobutane). Place a bung loosely in the opening of each test tube and put them into a 50°C water bath.
2. Place three test tubes each containing 5 cm^3 of silver nitrate solution into the water bath.
3. Once the solutions have reached the temperature, add the silver nitrate solution to a test tube containing a halogenoalkane, replace the bung and time how long it takes for a precipitate to appear.
4. Repeat step 3 for the other two halogenoalkanes.



Why is a water bath used when investigating the rate of hydrolysis of haloalkanes?



Why is a water bath used when investigating the rate of hydrolysis of haloalkanes?

To increase the temperature of the reactants so the rate of reaction is faster



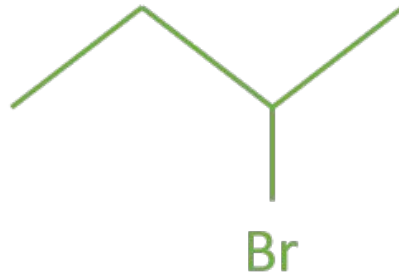
A halogenoalkane contains 4 carbons and bromine. Draw the primary, secondary and tertiary skeletal structures of this halogenoalkane.



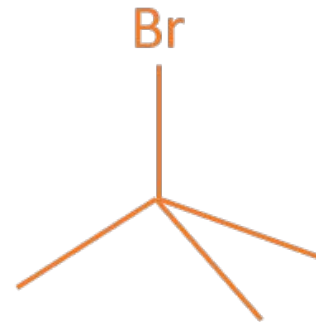
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Primary



Secondary



Tertiary



What must be done if NaOH is used to hydrolyse halogenoalkanes? Why?



What must be done if NaOH is used to hydrolyse halogenoalkanes? Why?

Before AgNO_3 is added, excess NaOH must be neutralised using HNO_3 . Otherwise, a brown precipitate of AgOH would form that would mask the result of other precipitates that form.



Write an equation for the reaction between 1-iodopropane and water



Write an equation for the reaction between
1-iodopropane and water



What colours are the precipitates that form when halide ions react with AgNO_3 ?



What colours are the precipitates that form when halide ions react with AgNO_3 ?

AgCl - white

AgBr - cream

AgI - yellow



Why is ethanol used when halogenoalkanes are hydrolysed?



Why is ethanol used when halogenoalkanes are hydrolysed?

Halogenoalkanes are insoluble in water. The halogenoalkanes dissolve in ethanol so that they can react with water.



How does the halogen in the halogenoalkane affect the rate of hydrolysis? Why?



How does the halogen in the halogenoalkane affect the rate of hydrolysis? Why?

Rate of hydrolysis increases down group 7 because the bond enthalpy of the carbon-halogen bond decreases down the group meaning less energy is needed to break this bond. This means hydrolysis of iodoalkanes will form a precipitate the fastest.



How does the type of halogenoalkane (primary, secondary or tertiary) affect the rate of hydrolysis of halogenoalkanes?



How does the type of halogenoalkane (primary, secondary or tertiary) affect the rate of hydrolysis of halogenoalkanes?

Tertiary halogenoalkanes are hydrolysed the fastest and primary halogenoalkanes are hydrolysed the slowest.

