Rates of reaction of halogenoalkanes.

Aim; the aim of this experiment is to investigate the factors that affect the rate of nucleophilic substitution reaction. (ref1)
Nucleophilic substitution is where an "electron rich" nucleophile selectively bonds with partially positive charge of an atom attached to a group or atoms called the leaving group; the positive or partially positive atom is referred to as an electrophile.

Apparatus
Goggles, for eye protection
Test tube rack and Test tubes
250cm beaker
Pipette
Thermometer to measure the temperature
Measuring cylinder
Halogenoalkes

1. 1-Chlorobutane(C_2H_5Cl)
2. 1-Bromobutane(C_2H_5Br)
3. 1-Iodobutane($C_2 H_5 I$)

Stop Watch
Diluted aqueous Sodium Hydroxide
Silver Nitrate solution at 0.1 mol dm^{-3}
Ethanol

Prediction
I predict that iodoalkane would react fastest because it's got the weakest bond because iodines the biggest molecule so the bond is longer and therefore weaker. The Electronegativity is factor that can have some influence in reaction of the haogenoalkane but in this case it is not as significant.

In this reaction the general equation is.

$$CH_3CH_2Br + OH^- \rightarrow CH_3CH_2OH + Br^-$$

In this reaction the OH^- ion acts as the Nucleophile as it is attracted to the positive charge on the carbon atom. [1] The positively charged dipole on this carbon atom arises as there is a large difference in the electro negativities of the halogen and carbon atoms causing the electrons to come closer to the Bromine, therefore Br becomes δ^- and C becomes δ^+.

Factors

When carrying out this experiment it is important to keep all the factors constant.

In this reaction the three factors that can have some affect on the outcome of the results are.

- **Concentration**- When the concentration of a reactant increases it leads to more collisions and therefore the rate of reaction increases. In order to keep this constant I will make sure the concentration of silver nitrate, which I will be adding, is kept the same throughout.
- **Temperatur**e- The higher the temperature of the chemicals/substances or the surroundings the higher the rate of reaction as the heat provides the particles with kinetic energy allowing them to collide into each other harder and faster. To keep this factor constant I shall make sure that the whole experiment is conducted at the room temperature, except when the haloalkanes are in the how water bath.
- **Pressure**-If the pressure is increased then the particles will collide into each other more often and more quickly there fore the number of successful collisions will increase.

Method

I am going to be using three halogenoalkanes 1-Chlorobutane; 1-Bromobutane and 1-Iodobutane.I shall have 3 test tubes, each of which will contain each of the halogenoalkanes and also 1cm ^{3} of ethanol.

Then I shall place the test tubes in water bath which will be set at about 50ºC.The at the same time I will put a tube containing 5cm^3 of 0.1 mol dm-^{3} silver nitrate solution in the same beaker.

Then I shall leave the test tubes for a few minutes, at least until they reach the temperature of the water bath.

Then finally when I have taken the test tubes out, I shall add a few drops of 1cm^3 silver nitrate solutions and time how long it takes for the solution to change colour or to form the precipitate.

I shall be testing to see which one reacts the quickest, and this I shall do by using a stopwatch. The halogenoalkane that produces the precipitate the quickest or in shortest time shall be the most reactive.

Various precipitates may be formed from the reaction between the silver and halide ions:

This equation shows the addition of silver nitrate solution to the halogenoalkane and the what it forms, which is a silver halide.

ion present	observation
Cl^-	white precipitate
Br^-	very pale cream precipitate
I^-	very pale yellow precipitate

(Ref2)

These are the expected colour of the precipitates that should be formed. When silver nitrate is added to the halogenoalkanes. The speed or time the mixture will take to reach this colour will inform me of its reactivity.

The mixture that produces the precipitate the quickest will be the most reactive.

Safety Hazards:

When undergoing these experiments there is always a risk involved as there are lots of potentially harmful chemicals and substances such as the Halogenoalkanes them selves , I shall have to be careful when handling them as they are both corrosive and irritants, so for safety reasons I will immediately wash my hands after handling these chemicals or after direct contact.

Also I will were protective goggles because the chemicals that I am going to be using are corrosive and irritants if any of it manages to get in my eyes then that can be very dangerous.

Sources/References

Reference 1. http://en.wikipedia.org/wiki/Nucleophilic_substitution
Reference: 2. http://www.chemguide.co.uk/organicprops/haloalkanes/agno3.html