CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY

Name(s)
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Project Number
S0510

Project Title
Temperature's Effect on the Collision Rate Factor

Abstract

Objectives/Goals
I wanted to do something useful for society. I had no trouble choosing a topic, as my head is always full of questions. Being more interested in chemical kinetics, I went beyond the ordinary high school textbook, and found the Arrhenius Equation.
The Arrhenius Equation inspired me to see if there was an equation for the Z-collision rate factor (a variable in the Arrhenius Equation). I had a feeling that somehow Z and temperature were related, and hypothesized a directly proportionality between Z and temperature. I prepared my procedures accordingly.

Methods/Materials
I used HCl and NaOH at dilute concentrations and small volumes for safety and to conserve resource. I used a pH probe, a magnetic stirrer, and a CBL. (I used the CBL to collect and to transfer the data to a TI 82) There were many challenges at first, things that seem as insignificant as how fast you pour the NaOH or where you pour it had a drastic effect on the data.

Results
In the end, I obtained data for 10oC, 23oC, 40oC, 60oC. Data were in the form of pH over time, so I had to convert it to [H+] over time, and then to rate of reaction over time, then to rate constant over time, then finally to Z over time. I averaged the Z at each temperature, and ended with an unique Z for each of the temperatures.

Conclusions/Discussion
After trying equation after equation, I decided that the data points are best represented by $Z = 24.4\ t^{(1/2)}$, where t is temperature in degrees Celsius.
Original hypothesis rejected.
(Actually, conclusion is still under revision as I add more statistical findings to support a best fit curve and infer the range where an actual curve should lie.)

Summary Statement
I am trying to find a causation between temperature and the z-collision rate factor.

Help Received
Received help from textbooks and from educational CDs. I am about to ask help from my stat teacher, Mr. Waters.