CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
Shant Krikorian

Project Number
22554

Project Title
Millikan's Oil Drop Experiment

Abstract

Objectives/Goals
The purpose of my project was to use Millikan#s oil drop experiment to experimentally determine the value of the electron charge, #e#, to demonstrate the discrete nature of the electron charge, and to determine that the charge is quantized. I hypothesized that an oil drop entering the space between the two copper plates would be affected by the uniform electric, gravitational fields, and the viscous drag (after applying a voltage on the plates). When the oil drop is motionless, mg=neV / d. To find the mass of the oil drop we need to find the terminal velocity, when there is no electric field. From the terminal velocity we can calculate the radius of the oil drop and from the radius we can calculate the volume. Therefore, mass can be found from the equation: mass=density x volume.

Methods/Materials
In this experiment I used a chamber, an atomizer, light oil, a variable DC power supply, a voltmeter, a telescope (with a reticule), a laser light, and a stopwatch. My independent variable in this experiment is, the stopping potential for the oil droplets, measured in volts and my dependent variable is the number of electrons on the oil droplets, measured in integer numbers. Therefore, I will be plotting mgd/ V as a function of the number of electrons on the oil droplet (n) and using the relation: mg=neV / d, when the oil drop is motionless. Thus, the slope of the graph is the value of the electron charge, #e#.

Results
My data/results were close compared to the established value of the electron charge. In my experiment, I found the value of the electron charge to be 1.53 x 10^-19 couloumb, compared to the established value which was 1.6 x 10^-19 couloumb.

Conclusions/Discussion
I did find that the charge was quantized and I found the electron charge to be within 9% of the actual value. Yes, my hypothesis supported my data. I stated that an oil drop entering the space between the two copper plates would be affected by the uniform electric and gravitational fields (after applying a voltage on the plates). When the oil drop is motionless, mg=neV / d, and that#s exactly what happened. My graph and overall results showed a 9% error, due to many factors. In my experiment, I did not take under consideration, barometric pressure, error calculating the radius, density, and speed which all could have changed my results.

Summary Statement
Using Millikan#s Oil Drop Experiment, I found the charge of the electron and proved that it was quantized.

Help Received
Advisor, Dr. Injeyan: gave me helpful hints and ideas to revise my project, he supplied me with different tools, and helped me define and understand different science terms that I was unfamiliar with. My geometry teacher, Ms. Woo: helped me understand and recognize all the equations in this experiment.