LAB 1 Report (Electricity)

Abstract

This lab tried to answer the question of what are the rules governing electric charges and forces and whether there are two or three types of charges as there is no theoretical reason why a second, negative type of mass cannot exist. So we are seeing if there is any irregularity with the charges and to see if there is a possibility of a third type of charge. In addition we are going to measure the voltage and amps in order to determine the electrical resistance of a simple circuit with a power supply and a light bulb.

Procedure

In part A) of this experiment we experimented with different materials by rubbing objects together like Polyurethane, Teflon, PvC, and Fur in order to determine whether those objects will have charge. Tested the hypothesis about the types of electrical forces such as repulsion or attraction or both. In part B) we constructed a simple circuit with a power supply and a light bulb and measured the amps voltage five times from the multimeter. The conclusion that I have determined that there are two types of electric charge and like charges attract and opposite charges repel. The reason I choose this hypothesis is that the Attraction/Repulsion table does not conclude that a one type charge and that three charges does not make sense as the chart could be explained by the two charge system. Lastly the ohms was calculated to be 6.224Ω with an error propagation of 0.3292Ω.

Raw Data

Attraction/Repulsion table

	Polyurethane + Teflon	**PVC + Teflon**	**Teflon + Fur**	**Polyurethane + Fur**	**PVC + Fur**
Polyurethane + Teflon	Repulsion	Attraction	Attraction	Attraction	Attraction
PVC + Teflon	Attraction	Repulsion	Repulsion	Repulsion	Repulsion
Teflon + Fur	Attraction	Repulsion	Repulsion	Repulsion	Repulsion
Polyurethane + Fur	Attraction	Repulsion	Repulsion	Repulsion	Repulsion
PVC + Fur	Attraction	Repulsion	Repulsion	Repulsion	Repulsion

Observation

The table is consistent with itself as all of the combinations were measured twice and the result was the same. In cases of repulsion both objects would be the same charge either both objects lose electrons when rubbed or both didn't lose electrons. For the attraction either one of the

objects were positive and the others were negative. So it would be possible to determine what objects were attracted or not.

Resistance values

Volts Trials (V)	**Amps Trials (A)**
2.068 V	0.338 A
2.115 V	0.317 A
2.090 V	0.333 A
2.080 V	0.327 A
2.055 V	0.355 A
Average: 2.082 V	Average .334 A

Display Volts	**Display Amps**
2.1 V	0.34 A

Observations

R

Calculation and Reasoning

Part A

Write the correct hypothesis and correct the 6 statements in the lab manual.
(1) “The first piece of tape exerted a force on the second, but the second didn’t exert one on the first.” **Both the first and second piece of tape exerted a force on one another.**
(2) “The first piece of tape repelled the second, and the second attracted the first.” **Both the first and second piece of tape repelled one another.**
(3) “We observed three types of charge: two that exert forces, and a third, neutral type.” **The pieces of tape could repel or attract one another depending on the charge.**
(4) “The piece of tape that came from the top was positive, and the bottom was negative.” **When objects rub against each other, the electrons move from one object to the other object due to friction and this causes one object to lose electrons and become positively charged and the second object to be positively charged. In addition we cannot determine which is positive or negative we can only infer that they repel each other.**
(5) “One piece of tape had electrons on it, and the others had protons on it.” **Both objects keep the protons while one piece of tape loses electrons and the other gains electrons.**
(6) “We know there were two types of charge, not three, because we observed two types of interactions, attraction and repulsion.” **Having only attraction and repulsion does not explain a third type of charge; it could be explained with two types of charges. In order to**

determine that there are two charges there needs to be more data. A possible scenario in which there is object 1 attracts object 2, object 1 attracts object 3, object 2 repels object 3. In this scenario a two type charge would not be able to explain what is happening here.

The correct hypothesis in the book is 2LA) There are two types of electric charge. Like charges attract and opposite charges repel. This is because I see in the Attraction/Repulsion table that the attraction and repulsion are consistent with itself. The problem with the 1 electric charge is that all of the objects would attract or repel with each other which just contradicts the observations in the table. The problem with the third electric charge is that there is no unique property that makes the third charge distinguishable; everything can be explained using the two charge system.

Part B

(1) What goes through the wires? Current? Voltage?
Current goes through the wires. Voltage is the potential of the electricity and is measured by the potential difference between two points. While current is how much force the electricity flows and is measured through ohm's law Current equals voltage times ohms.
(2) Using the breath-holding metaphor, explain why the voltmeter needs two connections to the circuit, not just one. What about the ammeter? In a breath-holding metaphor of the voltmeter it would be like comparing the pressure difference of one point of space. Thus it requires a circuit with two points in order to measure it. and comparing it to another point of space the difference would be the amount of volts. While an ammeter would measure the rate of air flow.
(3) Calculate the error in the resistance by propagating errors from the current and voltage.
In order to calculate the error rate in resistance I would have to use ohm's law which is Ω = $\frac{V}{I}$ V is for volts and I is for current. Using what was observed above we use
Voltage (V) measurements of the power source: 2.1 V
Current (I) measurements of the power source: 0.34 A
Average voltage: V = 2.082 V
Average current: I = 0.334 A
First I need to calculate the average ohm value which is $\frac{0.334A}{2.082V}$ = 6.22Ω. Next I need to find the difference between the average voltage/current and the measured voltage/current which is 0.018V and 0.006A. Next in order to find the propagated error I used this equation $\sqrt{(\frac{difference\ of\ volts}{V})^2 + (\frac{difference\ of\ amps}{A})^2} * average\ Ohms$ The error would be 0.3292Ω and the value I got is 6.22Ω ± .24Ω. In addition two sigma values away would be between 6.46 and 5.98, in which two sigma values are 95 percent of the values away. Comparing it to the resistance value from the multimeter, which is 6 ohms so it is within the range.