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Class: Physics II

Period: 2

Group #: 6

Lab # and Title: #10- Capacitance Variables

Laboratory Report

Purpose

The purpose is to discover the relationship of how capacitance changes when then distance between a parallel-plate capacitor increases.

Equipment Used

Parallel-plate Capacitor, Voltage Source, PASCO Electrometer, PASCO Variable Capacitor, and Red/Black Cables.

Background

A capacitor is a device used to store an electric charge, consisting of one or more pairs of conductors separated by an insulator. In a way, a capacitor is a little like a battery: it is used to store a charge. Although they work in completely different ways, capacitors and batteries both store electrical energy. Understanding this and further thinking about how the capacitance of a parallel-plate capacitor has variations when the plate separation is changed. Today, we will be using this equation to help understand how the distance and area of the parallel-plate capacitor is in relation.

$$C = \frac{\epsilon_0 A}{d}$$

$$C = \frac{Q}{V}$$

C = Capacitance

ϵ_0= Electrostatic constant

A=Area

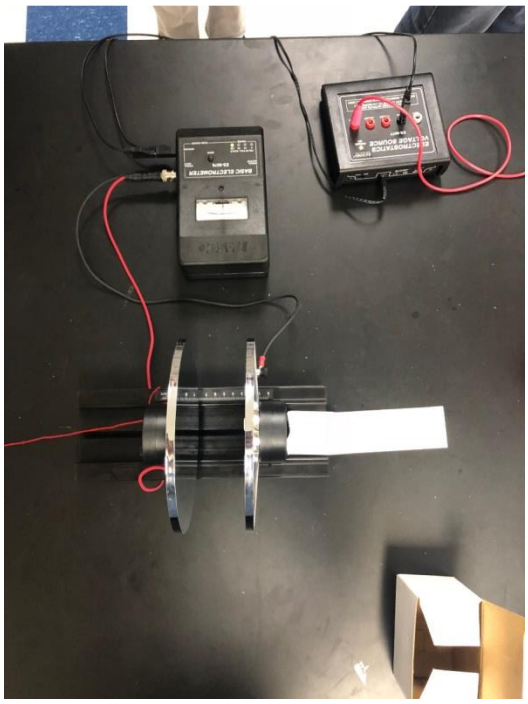
d=Distance

Q= Charge

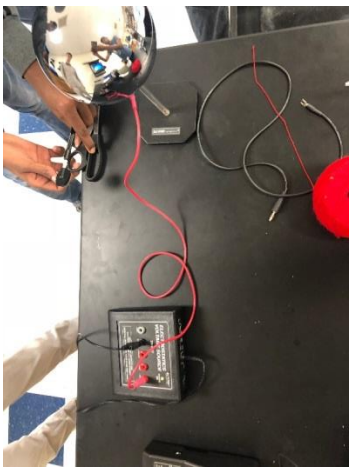
V= Voltage

Procedures

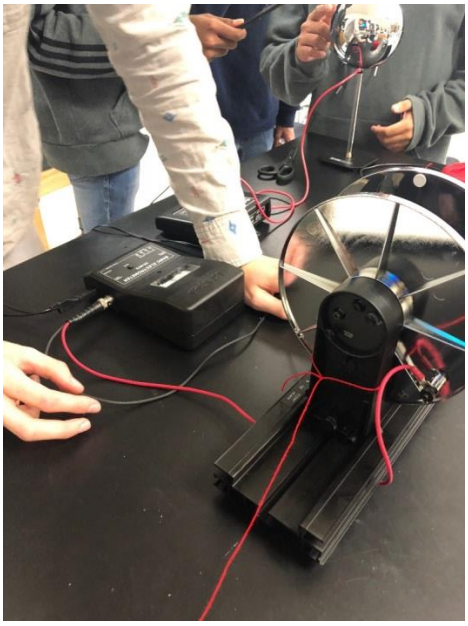
1. As seen in the picture, build the correct setup. Have the parallel-plate capacitors as close as possible, but still not touching. Attach the red wiring to both the electrostatics voltage source and the electrometer, do this based on how the wiring fits in the sockets given; be logical. Now the lab setup is complete. The red wiring will also attach to the moving plate while the black wire connecting to the electrometer will connect to the constant, not moving plate.



2. Now connect the sphere the voltage source attaching the wire by clasping the metal clip with the screw. Your setup should look like this now



3. Make sure to attach the black cables (with the plugs) to go into the COM socket of the voltage source then the side of the electrometer then finally into the ground terminal of the wall socket (the O open one in the side of the lab table). Then attach a string around the moveable plate (be sure to make it around the base as it will tip over if tied toward the top)
4. Your setup is finally complete and should look like the picture below



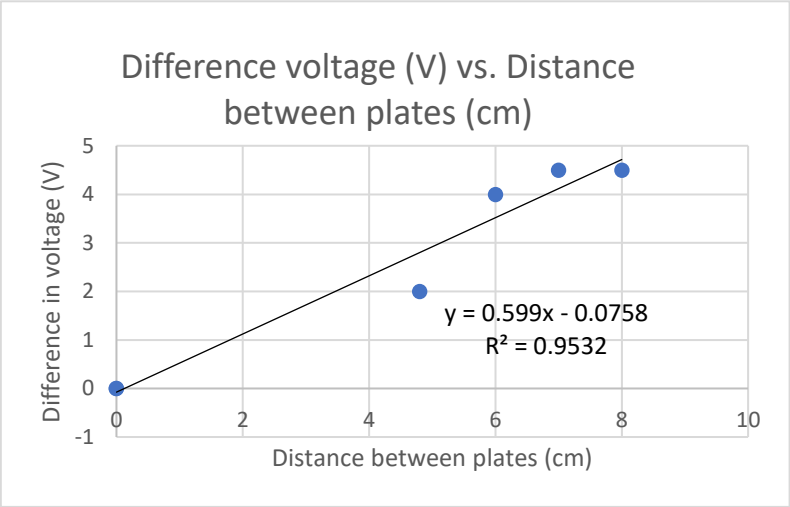
5. Turn on all the appliances and grab the metallic wand and touch the sphere, then touch the moveable plate a couple times. With every tap on the plate you should notice that the electrometer starts to move up a couple volts. Continually do this until the electrometer measures 200 V (or the 2 <- the 2 represents 200).
6. Slowly move back the moveable plate using the string, do not touch anything other than the string as it will affect your results. With increased distance you should notice a change in the electrometer.

7. At this point call one of the lab leaders for help to make sure the change is what is desired, much can go wrong in the lab! If all goes well then do the experiment at a variation of changing distances and mark how much the voltage changes.

*Don't forget to call for help if needed

Data

Distance between plates (cm)	Difference in voltage (V)
0	0
4.8	2
6	4
7	4.5
8	4.5
0	0



Analysis Questions

1. Why were both the capacitance equations used in the lab?

They were both used to determine the relationship between voltage and the distance between plates.

2. How are voltage and distance related?

Voltage and distance are directly proportional

3. Why would distance affect the difference in capacitance between both the plates?

Synthesis Questions

The farther away the plates the less attractive force there is between the plates so the charges move slower and the capacitance would be less.

1. If the substance between the parallel-plate capacitor were to not be air and was to be paper,

It would be lower because paper would act as an insulator that would slow down the current.

what would be the predicted outcome of the capacitance difference? Why?

2. What is predictive of the graph changing say the experiment was done on a separate day and the humidity was higher?

The moisture would result in a higher voltage reading than normal, resulting in a steeper slope.