Experiment #2 Lab Electrostatics Pre-lab Questions

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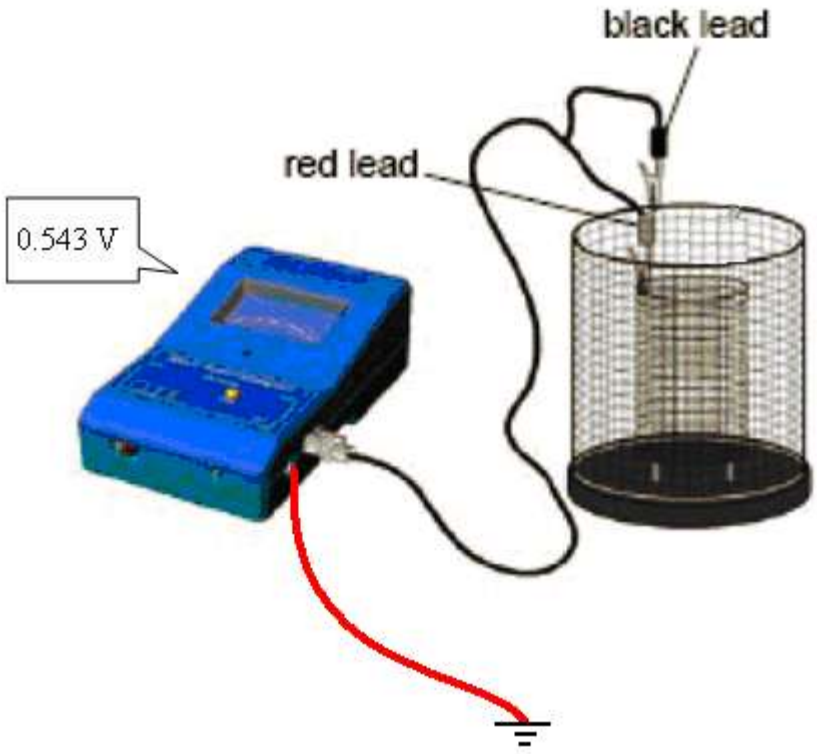
i. **What do you do if the electrometer is reading 0.543 V with nothing in the Faraday Ice Pail and everything is wired up correctly?**



This question is referring to the setup show above; where the Electrometer is connected to the Faraday Ice Pail and the electrometer is properly grounded, yet there is still a residual potential reading on the electrometer of 0.543 Volts.

If this is the case, then we should use the Zero Button on the front of the electrometer to remove excess charge from the meter and ground out the circuitry inside the device. Of course we are assuming that there is a banana cable connected to the ground port on the electrometer and to the ground in a wall electrical socket.

To ensure that we do not build up another false positive charge, we should be careful of the following:

ii. Equipment Orientation – As you will learn later in the semester; other circuits (computer, monitor, cables in the table/walls, other experimenters) can create magnetic fields which can interfere with your own circuit. In fact, the currents created in your circuits are trying to "counter" the effects imposed upon it by the other sources around it.

iii. Earth's Magnetic Field – Just like above, magnetic fields created by other electric circuits can interfere with the experiment, the Earth's Magnetic Field may create a small, yet measurable current in the circuits of our experiment.

iv. Unnecessary Movement – If you walk around, wave your arms, brush up against things, talk too much – you (the experimenter) and your lab partners may pick up a net charge. Just like case i above there may be negative effects due to this.

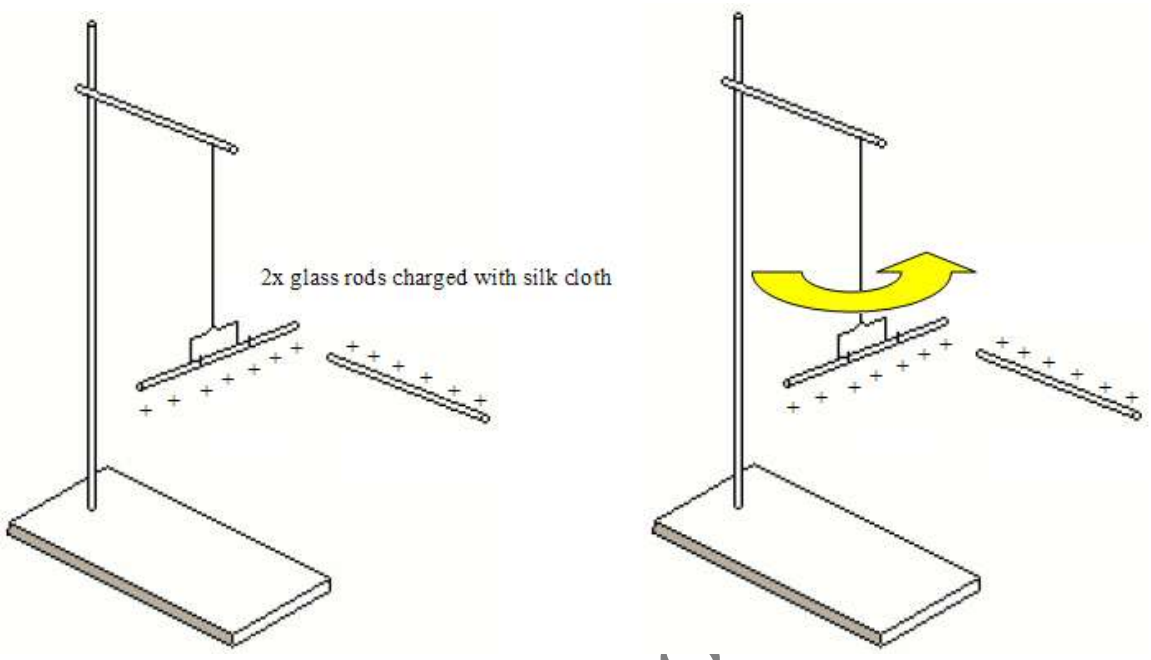
v. Earth Ground - The experimenter should be connected to an earth ground (something metal connected to the Earth – this is like a "zero button" for you). Stray charges on the experimenter can dramatically change the results of the experiment – as you will see in the procedure during the lab.

vi. Humidity – We all know how well water and electricity get along, right? A humid room (a room with a lot of water in the air) can cause charges to leak off any apparatus, which will in turn affect the charge on the Faraday Ice Pail. On the other hand, a particularly dry room can cause charge to easily build up in any moving object, including people. Try to minimize all movement when experimenting on a very dry day (which is usually the case in Colorado).

- **Repel or Attract? Two like charged rods.**

Everyone knows the answer to this from Elementary School Science Fair Projects. ☺ As the old saying goes: "***Like charges repel***, opposites attract." Isn't there something in a relationship book about that?

For today's lab, we will see this occurring in the following manner.

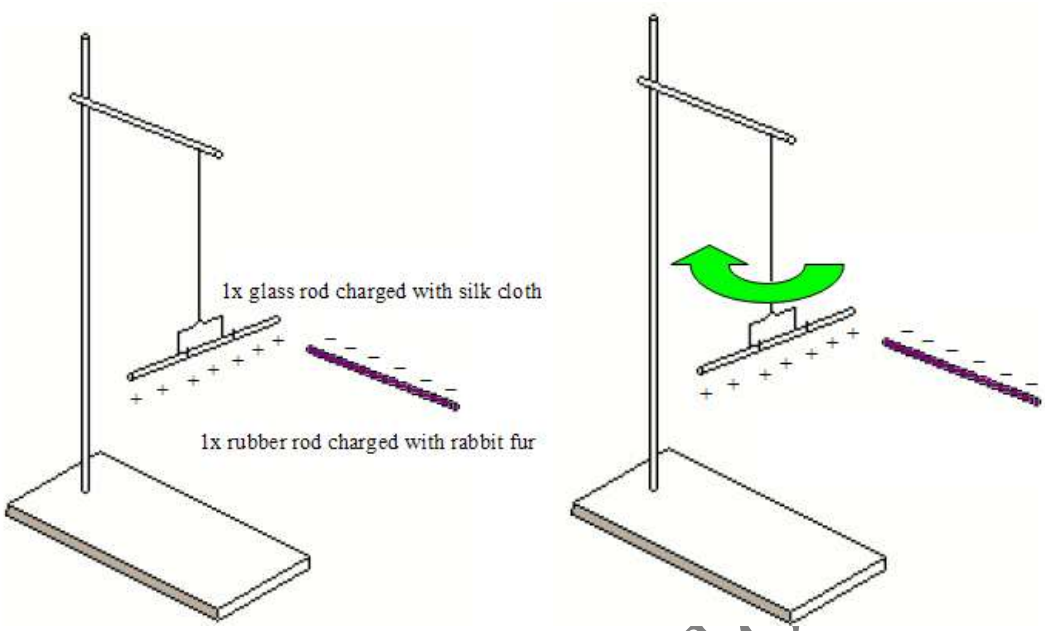


We will see that when we charge two glass rods to have a positive charge, by rubbing a silk cloth across them both several times, and bring one near another as shown above; the free-hanging glass rod will repel the like charged rod we are holding in our hand. This will cause the free-hanging glass rod to rotate away from the other glass rod. (In the figure above since we are bringing the second glass rod near the right side of the free-hanging glass rod, the free-hanging one will rotate counter-clock-wise to separate itself from the rod we are holding).

- **Repel or Attract? Two oppositely charged rods.**

This case, the opposite is true: "Like charges repel, ***opposites attract***."

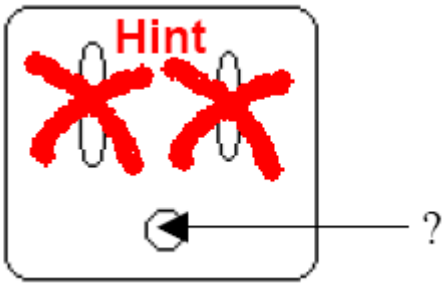
For today's lab, we will see this occurring in the following manner.



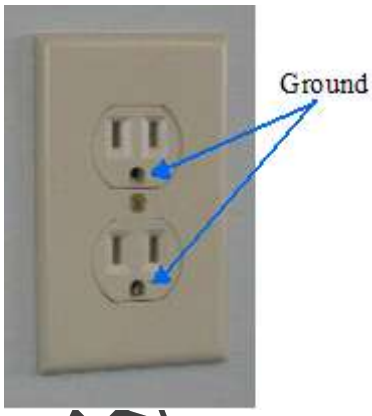
We will see that when we charge one glass rod to have a positive charge, by rubbing a silk cloth across it several times, and one rubber rod to have a negative charge, but rubbing rabbit fur across it several times; and bring one near another as shown above, the free-hanging glass rod will attract the opposite charged rod we are holding in our hand. This will cause the free-hanging glass rod to rotate toward the other rubber rod. (In the figure above since we are bringing the rubber rod near the right side of the free-hanging glass rod, the free-hanging one will rotate clock-wise to "get closer" to the rod we are holding **– all you sentimentalists in the class can now let out your drama-induced "Awwwh~~! Isn't that cute! The glass rod likes the rubber rod – so they're trying to get closer together! Hehe. ☺"**).

- Which hole is the **Ground** on a wall outlet?

Wall socket

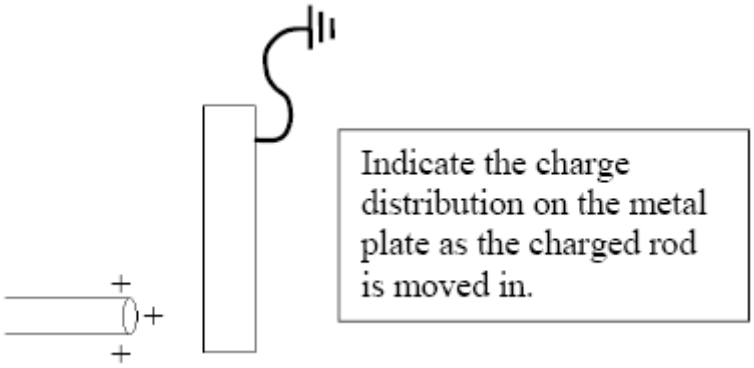


I'm going to take a stab in the dark here – and say the bottom one. If you want to see a "real picture" of the plug and where the ground is, see the image below:

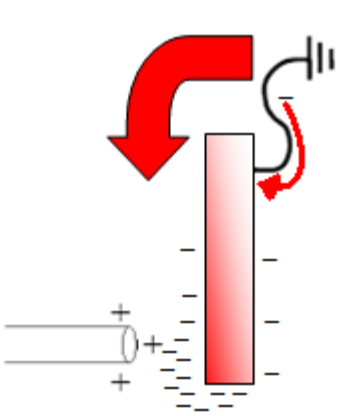


- **Observe the following series of events:**

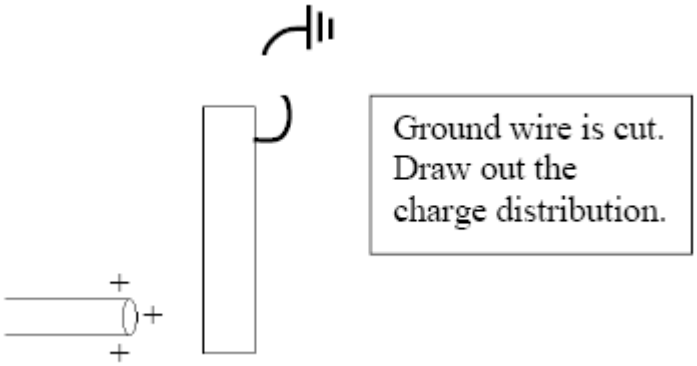
1.



As the charged rod is moved near the metal plate, electrons will start to flow from ground toward the region of the plate that is nearest to the positively charged rod. The flow of electrons will continue until the net charge on the plate exactly mirrors the charge on the rod.

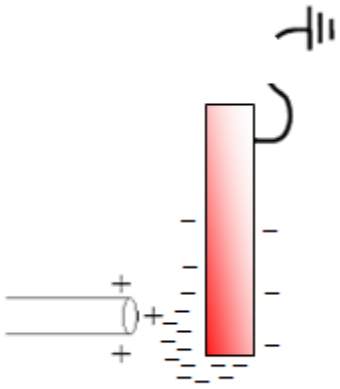


Note that in the image above the intensity of the color red represents of the density of charge at that specific location on the plate.



2. A

After the ground wire is "cut" (literally it is not "cut", but "disconnected"), as long as the positively charged rod is not moved (electro***statics***), the charge distribution will not change; however, the flow of electrons into the metal plate will stop.



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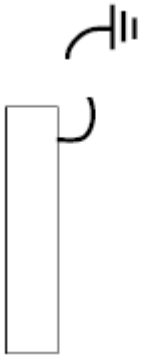

Charged rod taken away. What is the final charge distribution?

3.

After removing the positively charged rod "far enough" away from the metal plate there will be no attraction between the electrons in the metal plate and the rod. The electrons, now "trapped" in the plate, will repel each other and spread out as far away from each other as they physically can. This will create a uniform density distribution of the negative charge across the entire plate.