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Class: AP Physics II

Period: 9/26/18

Group #: 6

Lab # and Title: #7 – Charge Distribution

Laboratory Report

Purpose

The purpose of this lab is to determine the concentration of charge on a surface under certain conditions

Equipment Used

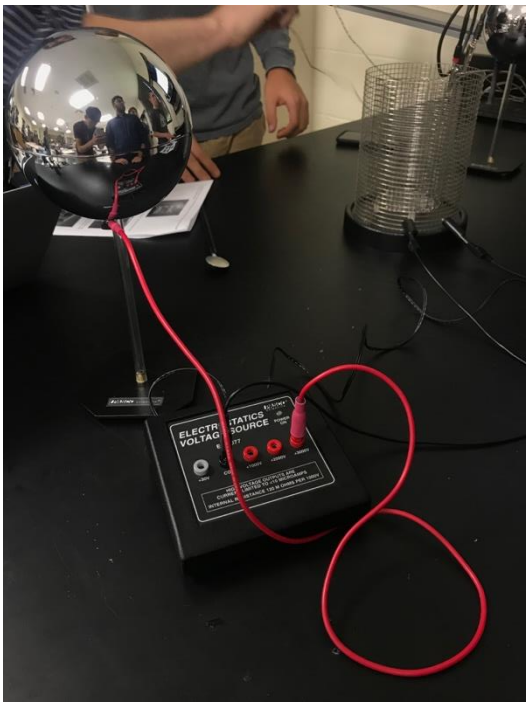
Meter stick, voltage source, caged ice pail, 2 metal spheres, proof plane, PASCO Charge Sensor, Wires

Procedure

Remember to take pictures!

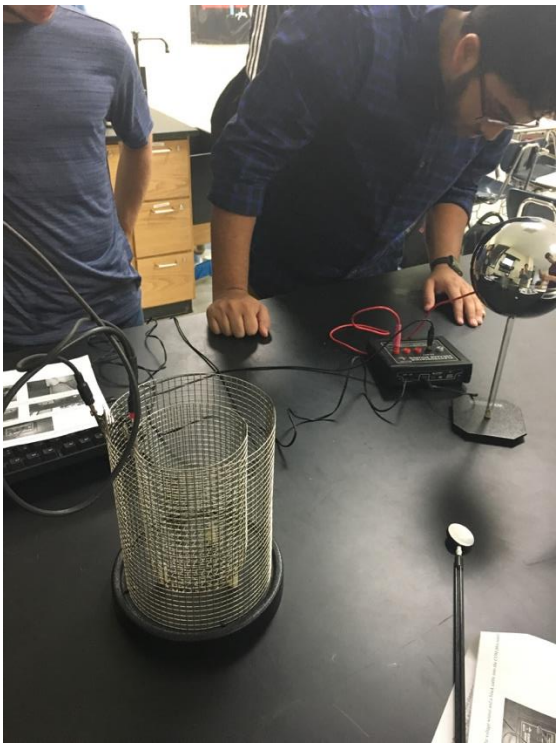
Setup

1. Plug the red cable into the +3000v output on the voltage source and insert and tighten the other side of the red cable to the screw under one of the spheres



2. Attach a black cable onto the COM (common grounded terminal) on the voltage source and attach the other side of this cable to the outer cage of the ice pail
3. Attach another black cable to the outer cage and the other end to an earth ground terminal in an electrical outlet

4. Attach the charge sensor to the inner and outer cages to record the charge difference between the two cages



5. Turn on the voltage source to give the metal sphere a positive charge along its surface

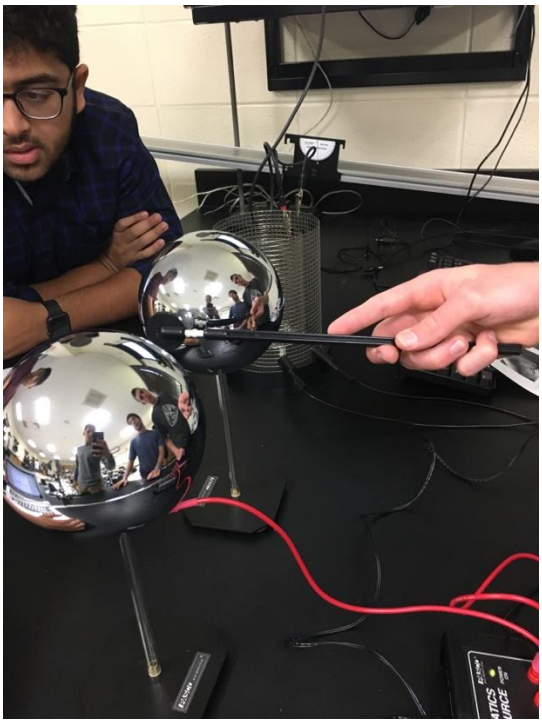
Examining the Positive Charge

6. Tap the proof plane on the surface of the charged sphere and dip it into the ice pail without touching it.

7. Examine the change in charge on the Data Studio program
8. Repeat steps 6 and 7 for other locations along the surface of the sphere
9. Before taking charge samples from other locations, ground (neutralize) the proof plane by tapping it to the outer cage (it will neutralize since the outer cage is attached directly to the earth)

Determining the Transition Line

10. Bring the uncharged sphere close but not touching the charged sphere (If touched, ground the neutral sphere by touching it to the outer cage)
11. Collect a sample from a location on the surface of the neutral sphere using the proof plane (noting the location) and dip it into the ice pail as before. Take note of the charge that is read from the sensor.

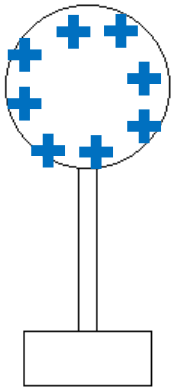


12. Ground the neutral sphere to neutralize the charges
13. Repeat step 11 and 12 on various other locations of the neutral sphere to determine the “transition line” between the negative to positive charge located on the sphere.

Data

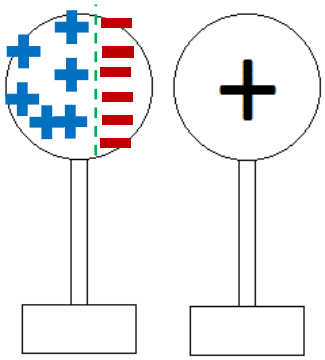
One Sphere System

On the diagram below, place the 8 positive charges around the circumference of the sphere to represent the approximate distribution of charge along the surface of the sphere.



Two Sphere Systems

On the two sphere system, place the 6 positive and 6 negative charges along the circumference of the neutral sphere to represent the approximate charge distribution of the positive and negative charge. Move the green vertical line to the location on the sphere that represents the "transition" from positive to negative.



Please ask the teacher to check your progress before moving on.

Analysis

1. In this experiment, were did the charge on the neutral sphere "transition" from positive to negative? Why do you believe it occurs at this location?

The transition line from positive to negative was closer to the positively charged sphere, with the negative charge closer to the charged orb. This was due to the fact that the positive sphere next to the neutral sphere was attracting the negative charges on the neutral sphere, causing them to be more concentrated.

2. The Earth is a great place to dump or take charge when needed and is generally has a fairly net neutral charge. Are objects which are grounded also guaranteed to be neutral when they do so? Can you think of an example in which an object which contacts Earth Ground would not be neutral?

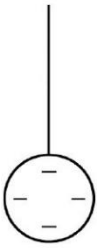
No, objects which are grounded aren't necessarily guaranteed to be neutral; for instance, when a neutral sphere close to a negatively charged sphere is grounded, the negative charges from the neutral sphere will move to the earth causing a remaining positive net charge in the right sphere.

3. What kind of effect does a smaller voltage (or strength of charge on the charged sphere) have on the location of the "transition line" of the neutral sphere?

The transition line will be closer to the center when the voltage on the charged sphere is lower.

4. What kind of effect does a larger distance of separation between the two spheres have on the location of the "transition line" of the neutral sphere?

A larger distance of separation between the two spheres causes the transition line to move closer to the end of the sphere, since the concentration of negative charges will be greater.



5. A metal sphere with a small negative charge hangs vertically from a light thread, as shown in the figure above. The metal sphere is then brought near but does not touch an uncharged plastic sphere of the same size that is also hanging vertically on a light thread. Which of the following best shows the two spheres after they have reached equilibrium?