

Electrostatics Lab

NAME _____ Period _____ Date _____

Objective: To study the effect of charges through the use of the electroscope

Apparatus: Glass Rod, Silk, Rubber Rod, Fur, Electroscope, 2 matches

The electroscope consists of a conducting metal bar with a metal ball at one end (the top) and two thin metal strips, called leaves, at the other end. The top end of the bar with the metal ball is outside of a glass box and the part with the leaves inside the glass box. The leaves are thin enough to bend when a weak force is applied. Since the bar is made of metal and a good conductor, the electron are free to move from one end to the other. **Do not ever touch the leaves.**

Remember when doing this lab to consider the three things that you know about charges:

- Charges are conserved
- Like charges repel each other
- Unlike charges attract each other

Part 1

First neutralize the electroscope by touching the knob(metal ball at the top of the electroscope). Rub the glass rod with the silk cloth. You may need to do this repeatedly to get a good charge. Bring the glass rod near and keep it there, but do not touch the knob and observe the leaves.

- What do the leaves do? _____
- Why would the leaves separate? _____
- What type of charge is on the glass rod? _____
- What type of charge is on the knob? _____
- Which particle is free to move in conductor, the electrons or the protons? _____
- What must the charge on the leaves be then? _____
- Which type of charging were you doing in this experiment: friction-touching (conduction), induction, or polarization? _____

Now remove the glass rod

- What happens to the leaves? _____
- Why? _____

Now rub the rubber rod with the fur. Then bring the rubber rod near and keep it there, but do not touch the knob of the electroscope.

- What do the leaves do? _____
- Why would the leaves separate? _____
- What type of charge is on the rubber rod? _____
- Which particle is free to move in conductor, the electrons or the protons? _____
- What type of charge is on the knob after you hold the rubber rod near it? _____
- What must the charge on the leaves be then? _____
- Which way did the electrons move this time, leaves to knob or knob to leaves? _____

- If you did not know the charge on the rubber rod or the glass rod before now would this experiment have let you know which Rod was positive and which Rod was negative? _____
- Why or Why not? _____

Part 2

Now Rub the glass rod with the silk cloth again. Now touch the knob (metal ball of the electroscope) with the glass rod and observe the leaves. Again, you may need to do this several times to get a good charge.

What do the leaves do? _____

Why would the leaves separate? _____

What type of charge is on the glass rod, after touching the electroscope? _____

What type of charge is on the knob now? _____

What type of charge on the leaves now? _____

From where and to where did the electrons move this time? _____

How is this different then the previous case (on the previous page) when you did not touch the glass rod to the knob and why are the charges now different then before? _____

Now remove the glass rod

What happens to the leaves? _____

Why? _____

Now rub the rubber rod with the fur. Now without discharging the electroscope (don't touch it) bring the rubber rod near the knob of the electroscope.

What do the leaves do? _____

What type of charge is on the rubber rod? _____

What type of charge is on the knob now? _____

What type of charge is now on the leaves? _____

Which way did the electrons move this time, leaves to knob or knob to leaves? _____

Why do the electrons move away or toward the rubber rod? _____

Now touch the rubber rod to the electroscope

What happens to the leaves? _____

What type of charge is on the rubber rod? _____

What type of charge is on the knob now? _____

What type of charge is now on the leaves? _____

When touching the electroscope with the charged rod you are charging the electroscope by which method: friction-touching (conduction), induction, or polarization? _____

Part 3

Use the fur to charge the rubber rod again and charge the electroscope by touching it. Now light a match and bring it close to the knob of the electroscope and observe.

The charge on the rubber rod is which negative or positive? _____

After touching the rod to it, the charge on the electroscope is? _____

What happened to the leaves after you brought the lighted match near the electroscope? _____

From what you know heat and the kinetic theory of temperature, temperature is really related to the average kinetic energy of the molecule. When the temperature is high, like on a lit match, then the molecules will move very fast. In some cases the molecules will move fast enough for some of the electrons to escape or the molecule to break apart. These molecules or atoms with either too few or too many electrons are called ions. If there are too few electrons the ion is positive. If there are too many electrons the ion is negative.

In this case, which ions will migrate (move) to the knob of the electroscope, the positive ions or the negative ions? _____

Why? _____

What will happen to the electrons on the electroscope? _____

Now repeat the previous procedure with the lit match, but this time use the glass rod to charge the electroscope.

In this case, which ions will migrate (move) to the knob of the electroscope, the positive ions or the negative ions? _____

Why? _____

What will happen to the electrons on the electroscope? _____

Use your observations from the experiment to answer the following questions and conclusions.

1. In the experiment there was no way to determine the charge on the electroscope unless you already knew the charge on the rods. What could you have done to determine the sign of the charge on the electroscope, if you did not already know the charge on the glass and rubber rods?
2. Why did the match discharge the electroscope in the lab and why didn't it make any difference whether the electroscope was charged positively or negatively?
3. State three ways that an object can be charged.
4. In the lab you neutralized the electroscope by touching it. What is this process called?

Conclusions:

1. Electricity consists of how many types of charges? _____
2. The names we assign to the charges are _____ and _____.
3. Objects that are alike in charge will have a force between them that is which, attractive or repulsive? _____
4. Objects that are different in charge will have a force between them that will do which, attract or repulse? _____
5. In solids which particle (s), the electron, the proton or both, is/are most likely to move? _____
6. In gases which particle(s), the electron, the proton or both, is/are most likely to move? _____