

Electrostatics

Recorder:

Goal: Investigate the nature of electric charges.

Procedure:

1. Set up the electroscope. Touch it with your hand to “ground” it and carry away any charge which was present. Repeat this grounding process regularly throughout the experiments.
2. You will vigorously rub several different rods with different objects and observe what happens when:
 - a) you bring the rod near to but not touching (2 or 3 cm away) the electroscope (charge separation)
 - b) you touch the rod to the electroscope (conduction)
 - c) you touch the rod to the electroscope while simultaneously touching the opposite side of the electroscope with your hand (induction)

Pre-activity questions and hypotheses:

How do you expect the composition of the rod to affect the charge? the composition of the rubbing substance?

With which technique do you expect the greatest charge to be transferred to the electroscope? Why?

Process #1 – Charge Separation

- 1) Vigorously rub the Lucite or glass rod with the silk.
- 2) Hold the rod horizontally about 2 or 3 cm above the plate of the electroscope. Don't touch the rod to the metal plate!
- 3) Observe and record the effect on the meter.

- 4) Observe and record what happens to the meter after removing the rod.

- 5) Touch the plate of the electroscope with your finger and observe the effect.

- 6) Repeat this test with the rubber rod which has been rubbed with the fur.

Useful fact: Fur and Lucite lose electrons more easily than silk or rubber.

What is the charge of the Lucite rod after being rubbed with the silk?

What is the charge of the rubber rod after being rubbed with the fur?

Assuming that you properly grounded the electroscope before using it, it should have no net charge. How do you explain the behavior of the meter in the presence of the charged rods? Include a sketch to show the process. (think about balloons on whiteboards)

Process #2b – Conduction

- 1) Repeat the Rubber and fur rubbing process, but this time rub the Lucite rod on the plate of the electroscope to transfer some of the charge to the plate. You may want to re-rub the rod and rub the plate again to get a good charge transfer.
- 2) Observe and record what happens to the meter.
- 3) Observe and record what happens when you remove the rod.
- 4) Touch the plate with your finger and observe what happens to the meter.

How is the behavior of the meter in this case similar to that of Process #1? How is it different? Explain the differences.

What happens when you touch the meter with your finger? Why?

Process #2a – Conduction

1) Repeat the rubber and fur rubbing process and rub the electroscope plate until you get good charge transferred.

What type of charge does the electroscope have?

2) Rub the Lucite rod with the silk.

What type of charge does the rubber rod have?

3) Observe and record what happens when you bring the Lucite rod near the electroscope without touching it.

4) Record what happens when you take the rod away.

5) Touch the plate with the Lucite rod. What happens now?

6) What happens when you remove the rod?

7) Touch the plate with your finger and observe what happens to the meter.

Explain what is happening with the electrostatic charge in this scenario.

Do you think there is any charge left in the rod after it touches the plate? Test your hypothesis.

Process 3 – Induction (warning – this is a tricky one!)

1) Repeat the rod rubbing process (either type).

What type of charge does the rod have?

2) Bring the rod near (but NOT touching) the plate of the electroscope. (the meter should move significantly)

3) Touch the **opposite** edge of the electroscope plate with your hand (still don't let the rod touch)

4) Remove your hand while holding the rod in place.

What happens to the meter?

5) Remove the rod.

What happens to the meter?

What is going on here? This is tricky. Think about it and try drawing a sketch of the charges before you give up and claim confusion.

What do you think will happen if you touch the electroscope plate with your finger? Test your hypothesis.