Experiments with Static Electric Charges
Spring 2026

Introduction

This series of experiments are designed to give you an understanding of how electric charges behave on insulators and conductors.

Experiments

1. *Using an oscilloscope to identify net charge:* Charges usually are left on the surface of insulators (e.g. plastic, glass, rubber) after they are rubbed with a piece of silk, bubble wrap or fur. You will use an oscilloscope to test two different insulators (rubber and glass) after they have been rubbed with different materials to see whether the net charge on the insulator is positive or negative. The oscilloscope has been set up to show a bright spot at the center; the spot is caused by electrons (negatively charged) striking a phosphor coating on the back of the glass screen.

   a. Bring the two rods, fur, and bubble wrap to the oscilloscope at the front of the lab. *Vigorously* rub the rubber rod with a piece of fur and carefully bring it close to the face of the oscilloscope. Use the *side* of the rod, not the tip, for the best results; don't let the rod touch the glass surface of the oscilloscope. Move the rod up and down, parallel to the glass screen. Briefly describe your observations of the behavior of the spot with respect to this charged rod.

   b. Now vigorously rub the glass rod with a piece of bubble wrap and again bring the side of the rod close to the glass screen of the oscilloscope. Again, describe your observations.

   c. Based on your observations, which rod (rubber or glass) ends up with a net negative charge, and which with a net positive charge (**Figure 1**)?

Figure 1: Rods showing a net charge.

2. *Charging a conductor*:

   a. A piece of aluminum foil is suspended by a silk thread. Ground the foil by touching it with your fingers; this will remove any excess charge that is on the foil (**Figure 2**). Note that there are an equal number of positive and negative charges.

   b. Charge the rubber rod with fur, then *slowly* bring it near the foil – ***don't let the rod and foil touch just yet!*** Describe what happens and explain why. Draw a sketch on a piece of graph paper of the charged rod and the foil when they're close but haven't yet touched. Be sure to show charges on the rod and how the charges move on the foil.

   c. Now let the charged rubber rod touch the foil and then hold the rod near the foil. Again, describe what happens, and explain why. Draw another sketch showing the charges on the foil after contacting the charged rod.

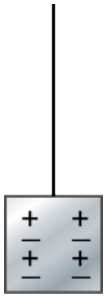

Figure 2: Neutral foil

   d. Charge the glass rod with the bubble wrap and carefully move it toward the charged foil (***don't let the rod touch the foil!***). Describe the reaction of the foil.

   e. Note that you have created a device that will detect the presence of a charged object; if you know the charge on the foil, you can then determine the sign of the charge on the object by observing the behavior of the foil. Do your results for the charge on each rod agree with your results using the oscilloscope?

3. *Fun with water:*

   a. Turn on the faucet to produce a thin, smoothly flowing stream of water (your instructor can assist you in using the cruddy faucet). **Figure 3** shows a simplified view of the charge distribution in the water stream.

   b. Charge the rubber rod with fur and hold the side of the rod next to the water stream (*don't get the rod or the fur wet!*). Describe what happens and draw the appropriate figure on a piece of graph paper to represent the water stream attracted to the charged rod (**Figure 4a**) or repelled from the charged rod (**Figure 4b**).

   c. What do you think is happening to the charges in the water stream? Draw some charges on the rod and water stream of the journal figure you just drew.

   d. Record in your journal a prediction of how the stream will react when the glass rod charged with the bubble wrap is held close. Try it, describe the results, and explain why it happens, including another sketch.

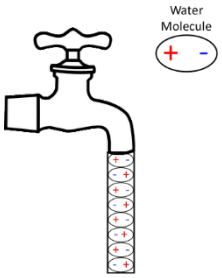

Figure 3: A simplified representation of a neutral stream of charged water molecules (small ovals). Note the arrangement of charges in the water molecules.

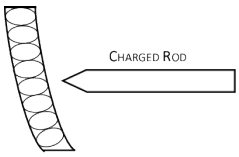

Figure 4a: A stream of water *attracted* to a charged rod. Note that charges have been omitted from this figure.

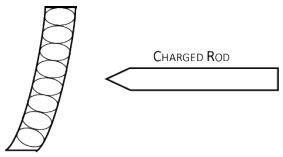

Figure 4b: A stream of water *repelled* by a charged rod.

4. *Challenge: Can You Separate Charges?*

   a. You are provided with two metal spheres on insulating stands (**Figure 3A**, in their neutral state). Using these spheres, the rubber rod, and the fur, figure out a way to give the metal spheres equal but opposite charges *without* touching either sphere with the rod or fur (the spheres *can* touch each other), as shown below in **Figure 3B**. The goal is to have each sphere retain its net charge when you are finished. Listen carefully while performing this experiment; if you hear a static "click", then there has been a transfer of charge, and the experiment won't work.

   b. Test the charge on each sphere by using the foil "charge detector" you created in step 2.

   c. Briefly describe your solution in your journal.

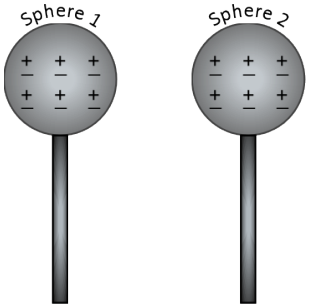

Figure 3A: *Before* contact, both spheres are neutral

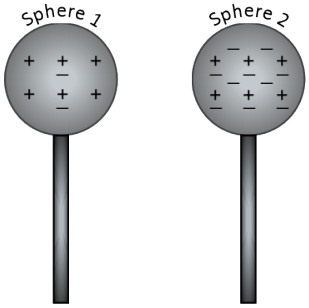

Figure 3B: *After* contact, each sphere has a net charge

5. *Why are you safe in your car during a lightning storm?*

   a. Your instructor will perform a demonstration for you where charge will be applied to a hollow metal sphere. Briefly describe what you observe and explain why you are safe in your car during a lightning storm.