

Coulomb's Law and Scotch Tape

Goal:

- To explore Coulomb's Law and verify that the electric force is inversely proportional to the distance between charges.
- To determine the approximate amount of charge on strips of scotch tape and the polarity of that charge.

Materials:

- Scotch tape roll
- Ruler
- Protractor
- Fur
- Rubber rod

Procedure:

1. Charging Scotch Tape
 - a. First charge a strip of Scotch tape. To do this, lay a strip of tape sticky side down on a table top. Call this piece of tape the Base Tape. Now take another strip of tape from the roll, make a handle on one end by folding over a small portion onto itself (this will make the piece of tape easier to handle during the experiment), and then lay this strip of tape on top of your Base Tape. Call the strip of tape with the handle the Top Tape. Quickly peel the Top Tape off of the Base Tape and test whether it is charged by holding it near (but not touching) your finger.
 - b. Determine the polarity of the charged tape by holding it near a rubber rod that has been charged by conduction with fur. Recall that the rubber rod becomes negatively charged after being rubbed with the fur (Section 15.1 in your book). How the tape and rod interact will tell you the polarity of the charge on the tape. Make note of this in your lab notebook.
2. Verifying Coulomb's Law
 - a. Charge two strips of tape in the same manner as before, making sure to make them the same length (if you want to reuse the strip of tape from before, ground the charge on the tape first by passing your hand over the tape). Measure the length of the strips and record this in your notebook.
 - b. Once you have charged two strips of tape, hold the two strips some distance apart (perhaps start at 15 cm or so). Measure the angle of deflection for one of the tapes. This angle will be an estimate since you'll notice that the strips curve a bit. Do your best. Record this angle along with the distance between the tapes.
 - c. Repeat this process for several distances (the more you have, the better your data).
 - d. The electric force on one strip from the other will be roughly horizontal. Draw a free body diagram for one of the strips. This should help you determine the magnitude of this horizontal electric force. Remember, you know the length of the strip and the angle of deflection. Be sure to record to calculation of the electric force with the distance and angle data with which it corresponds.
 - e. Coulomb's Law says that the electric force is inversely proportional to the square of the separation distance. If you were to plot a graph of F vs. $1/r^2$, you should find that the graph has a straight line (linear relationship, which verifies Coulomb's Law). Plot this graph and draw a best fit line. If your data does not fit a straight line, provide possible explanations and sources of error.
3. Determine the Charge on the Strips of Tape

Your challenge now is to figure a way to determine the charge on the strips. Remember to record everything in your notebook and report your method in your lab report.