Experiment #2  Electrostatics

About this experiment

This experiment is composed of three parts.

1. In the first part, you will learn how to use an electrometer to measure a voltage, and then use it to testify the relation between current, charge, voltage, capacitance and resistance.

2. In the second part, I will show you several phenomena about electrostatics. You should repeat these small experiments and observe those phenomena.

3. In the third part, we will not cover all the parts written in lab manual, say, we will skip part 3.3, 3.4, and 3.6.

Some requirements on Lab Report

1. In the first part, you are required to use an electrometer (not a voltmeter as in lab manual) to testify the relation between current, charge, voltage, capacitance and resistance. Record your data, and try to verify the theoretical equation.

2. In the second part, select two experiments that you are most interested in, try to complete them. In your lab report, describe the phenomena and give detailed physical explanations about them. For other experiments in this part, try to work them out if time permitted.

3. In your lab reports, you should cover these about this part:

3.1 Use the known capacitance to measure the other two capacitances, record your data and compare with the real value indicated by the codes.

3.2 Use multimeter to measure the whole capacitance when two capacitors are connected in parallel and in series. Compare with the theoretical predictions.

3.3 Measure the capacitance of the cylinder capacitor, compare with the theoretical value, the geometrical dimension of the cylinder could be found in lab manual.

3.4 Measure the relation between the angle and the electric field (indicate by the voltage drop on the electrode), list the data in a table, and draw a figure to show this relation.

3.5 Use the phenolic rod as the source of electric field. Measure the relation between the electric field (indicate by the voltage drop on the electrode) and the distance from the source. List the data in a table and draw a figure to show this relation. Use excel or other software to fit this relation in the form of $y=Ax^{-\alpha}$, compare $\alpha$ with theoretical value $\alpha=-1.0$.

Notice

- Never apply voltages much more than 3V on the electrometer input. Do not touch the electrometer input with your hands unless first discharge yourself.

- When measure a capacitance, do not forget to discharge it first.

- Be careful not to short the two electrodes of the battery or power supply, and not to connect your circuit incorrectly. Since there is a big grounded metal board on your station, it is very easy to make such kind of mistakes.