Electric Fields Lab

AP Physics C: Mr. Perkins

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Due: February 15, 2023

1 Introduction

Using a piece of carbon paper, we investigate the behavior of conductors on electric fields. Two aluminum plates are placed on either side to create an electric field using a 9V batter. The 8.5 by 11 carbon paper is placed in between the plates and the voltage is measured using a multimeter. The voltage is measured at different distances from the plates.

2 Data

2.1 Carbon Paper

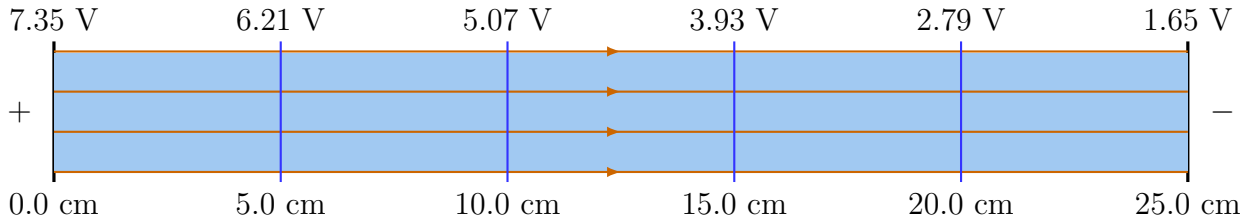

Figure 1: Equipotential Lines and Electric Field Lines for No Carbon Paper

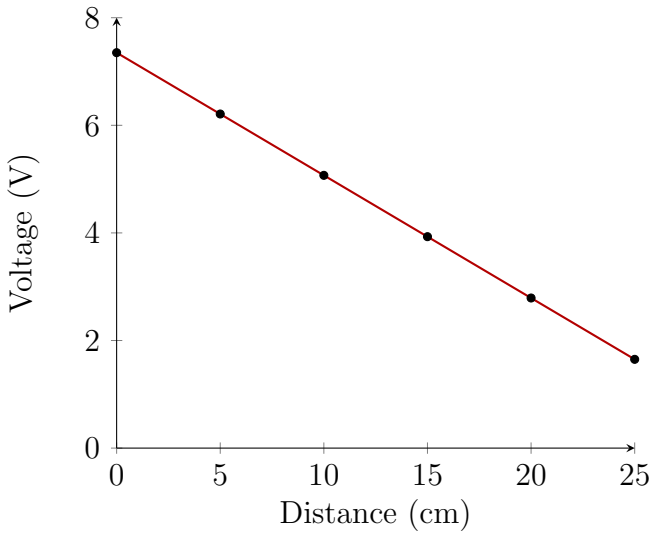

Figure 2: Voltage vs Distance for No Carbon Paper

2.2 With Piece of Aluminum

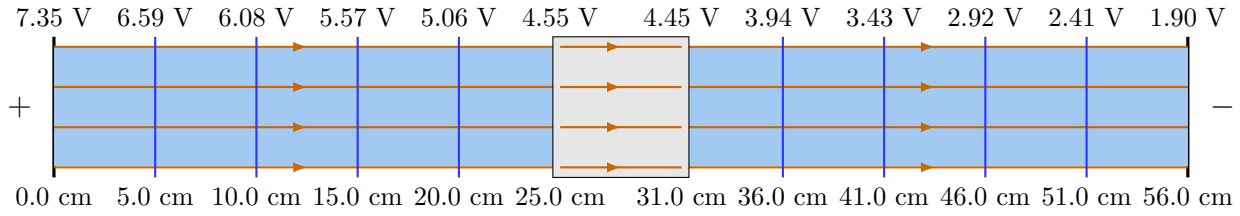

Figure 3: Equipotential Lines and Electric Field Lines for Carbon Paper

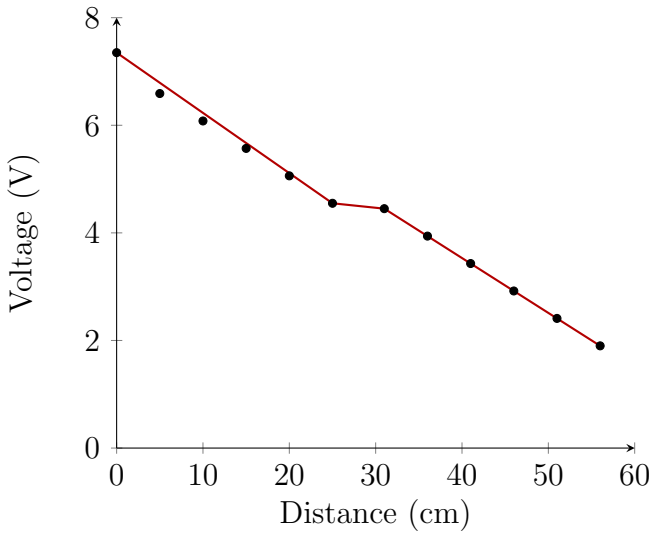

Figure 4: Voltage vs Distance for Carbon Paper

3 No Conductive Paper

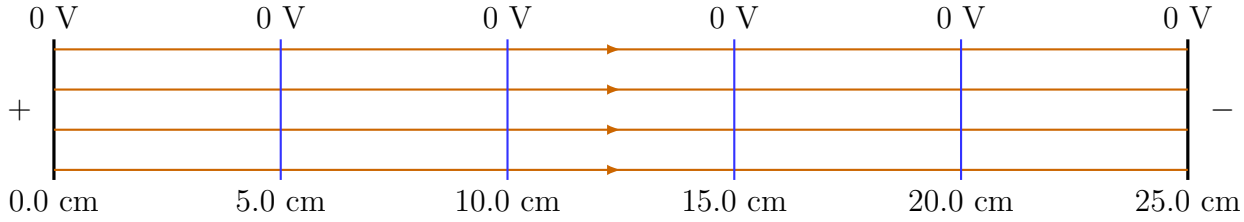

Figure 5: Equipotential Lines and Electric Field Lines Through Air

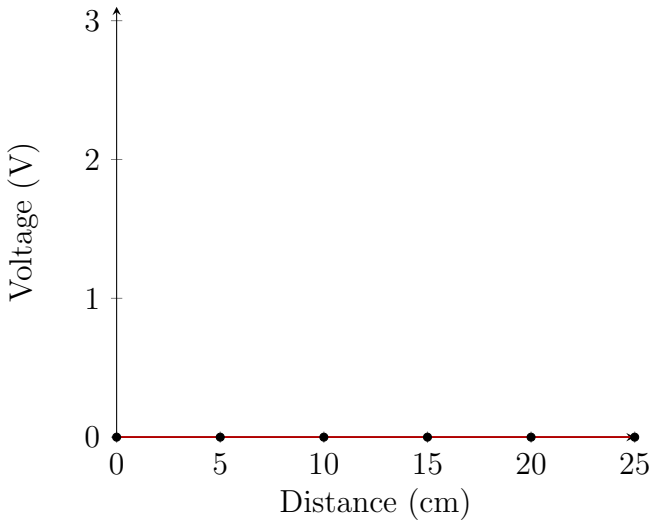

Figure 6: Voltage vs Distance No Conductive Paper

4 Analysis

1) **In the first experiment, sketch the equipotential lines and the electric field. Graph V vs x.**

Refer to Figure 1 and Figure 2.

2) **Why is there a 2-3 volt difference between the aluminum and the paper? Be specific...use the language of conductor, resistor, etc.**

There is resistance in the paper, so the voltage is lower than the voltage on the aluminum plates. As $\Delta V = IR$, there is a voltage drop between the aluminum plates and the paper because resistance is present. As such, at 0 cm, the voltage is 2 to 3 V lower than 9V and why at 25 cm, the voltage is greater than 0 V.

3) **Measure the resistance from one end to the other—what current is flowing through this system, in amps?**

$$R = 4900\Omega$$
$$I = \frac{V}{R} = \frac{9}{4900} = 0.00184 \text{ A}$$

4) **For the second experiment, sketch the equipotential lines and the electric field. Graph V vs x.**

Refer to Figure 3 and Figure 4.

5) **How is this example different than the previous experiment? Why are these differences there?**

This example is different because aluminum is a good conductor, and therefore there is little resistance in the aluminum. As such, from $\Delta V = IR$, there is little voltage drop

traveling through the aluminum. By placing the aluminum in the middle of the paper, the voltage drops as it travels through the paper, then remains nearly the same as it travels through the aluminum, and then proceeds to drop again as it travels through the paper. The electric field is also weaker because we increased the distance between the plates.

6) **For the third case, why do you get a frustratingly simple graph?**

The graph is simple because there is no electric field through the table.

7) **Is there any other combination of conductor and insulator (semi-conductor, in this case) that you'd like to try? Set it up.**

We tried a similar experiment to Experiment 1, but instead of using carbon paper, we used aluminum foil. However, due to the low resistance in the aluminum foil, we created a large current, causing the battery to short circuit.