

## Electric Fields and Potential

As you work through the steps in the lab procedure, record your experimental values and the results on this worksheet. Use the exact values you record for your data to make later calculations.

### Electric Field - Simulation

Open the Electric Field Mapping simulation to do this lab.

### Explore the Apparatus

4. Drag the probe  $\oplus$  to the center of the electrode on the left. Record the voltmeter reading.
5. Drag the probe to the center of the electrode on the right. Record the voltmeter reading.
6. What is the potential difference between the two electrodes?

### Some Points About Electric Field Lines and Equipotential Lines

20. Why couldn't a field line that starts at 7 o'clock on the positive charge end on 2 o'clock on the negative charge?

21. Why would equipotential lines never cross?

### Charged Conductors in Electrostatic Equilibrium

22. If a collection of electrons were added to a conductor, they would all begin to move apart, thus reducing the total amount of repulsive force between them. Any charge not on the surface of the conductor could get farther away, on average, from all the others by moving to the surface. So all charges will eventually end up on the surface of the conductor with no net force acting to move them elsewhere. For this reason the surface of any conductor in electrostatic equilibrium is an equipotential surface, or an equipotential line for our 2D objects.

How does this explain why electric field lines are always perpendicular to such a surface?

## I. The Field Produced by a Pair of Equally but Oppositely Charged Parallel Plates

For each part of the procedure, use  $V$  for your power supply voltage,  $V_{ps}$ . 19. Upload your **Screenshot** with the file name "EFields\_plates.png". (Submit a file with a maximum size of 1 MB. *You will upload this file in the WebAssign question.*)

## II. The Field Produced by an Electric Dipole

9. Upload your **Screenshot** with the file name "EFields\_dipole.png". (Submit a file with a maximum size of 1 MB. *You will upload this file in the WebAssign question.*)

### A 3D Perspective of Electric Potential-Electric Dipole

11. Think about what this 3D graph would look like for an alternating current. That is, if the positive side gradually reduced in positive voltage down to zero and then continued on until it reached -40 V, and then went in reverse back up to 40 V, etc. The reverse would be happening on the other side. Describe what this animated graph would look like over time.

### III. The Field Inside a Circular Conducting Ring between a Pair of Equally but Oppositely Charged Parallel Plates; Shielding

For this part of the lab, use 40 V for your power supply voltage,  $V_{ps}$ .

19. Take a **Screenshot** that includes all of the grid plus the voltmeter and power supply. Save it as "EFields\_shielding.png". Upload your **Screenshot**. (Submit a file with a maximum size of 1 MB. *You will upload this file in the WebAssign question.*)