

Electric Charge and Field

Physics 225 – Week 1 Activity

WHAT YOU'LL PRACTICE: LEARNING OBJECTIVES

- Asking and answering questions in an experiment: designing an experiment to test a theory
- Effective writing: organizing information
- Using graphs, statistics, and uncertainty to make claims
 - Incorporating and interpreting uncertainties in graphs

BEFORE, DURING, AFTER

1. Before the experiment, read this document and finish the prelab on Blackboard.
2. During the experiment, take notes in your lab notebook.
3. After the experiment, collaborate with your team on a post-lab report.

PRACTICE QUESTIONS

Here are the questions you will answer using this week's materials:

- ① How does the electric field vary with position around a point charge? Does it vary with direction? Does it vary with distance?
- ② How does the electric field vary with position around an electric dipole?

RESOURCES

Lab documents:

Background information about charges and electric field equations:
<https://drive.google.com/file/d/1cctsgPxVZvM7NfEeEjbQxhUgDlrLzIH0/view?usp=sharing>

Simulation: This week we will use the following applet to study electric fields:
https://phet.colorado.edu/sims/html/charges-and-fields/latest/charges-and-fields_en.html

EXPLORE QUALITATIVELY

Launch the applet, and take time to familiarize yourself with the controls. Place down one point charge, and use sensor(s) to probe the electric field at various points. You should be able to see the electric field in V/m (volts per meter). The grid, and values, should be turned on.

- 1 From your observations, discuss with your group how the electric field varies with **direction** and **distance** from a point charge. You don't need an equation yet; just record in your notebook whether the field increases, decreases, or stays the same as you test positions.
- 2 Now create an electric dipole, perform similar observations, and record your results in your notebook.

EXPLORE QUANTITATIVELY

It's now time to gather numerical data for comparison with equations we know from the background materials.

- 1 Collect data on how the electric field varies with position from a point charge. Remember that all measurements have three parts: **value, units, and uncertainty**.

Tip: The uncertainty in a digital measurement is a 1 in the smallest decimal place.

- 2 After you've collected data from a point charge, collect data for a dipole. The background information about dipoles should help you plan measurements. Remember that the approximate equations for the dipole field are only valid for a limited range of positions. Discuss this with your instructor if you're unsure!

Use Graphical Analysis to graph your data. Add fits to test agreement with the background equations. Consult the formatting guidelines on Blackboard for information about graphs, fits, and error bars.

Have your instructor check your lab notebook and graphs.

DELIVERABLES

As a group, use the Lab Work Submission form to finish the post-lab activity. Save your work as a PDF file, and then submit it on Blackboard.