

Visualizing an Electric Field

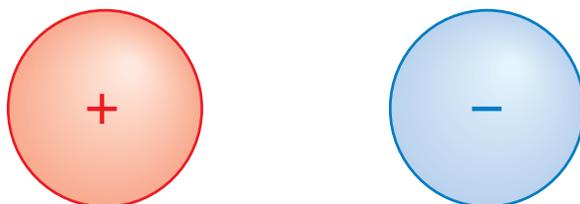
COMPUTER SIMULATION

A FIELD THAT EXERTS a force on a charge or a charged object is an **electric field**. Electric fields affect all objects that have a positive or negative charge. For objects with a neutral charge, the field can cause the separation of charges inside the object.

The field around a charge extends through three-dimensional space. Like all fields, we are not able to see an electric field. In this activity, you will use a computer simulation to model charges to map an electric field.

GUIDING QUESTION

What effect does an electric charge have on the space around it?



What would a map of the electric field between these two charges look like?

MATERIALS

For each student

- 1 computer with Internet access
- 1 Student Sheet 1, “Talking Drawing: Visualizing an Electric Field”
- 1 Student Sheet 2, “Modeling Charges”

PROCEDURE

Use Student Sheet 10.1, “Talking Drawing: Visualizing an Electric Field,” to prepare for the following activity.

Part A: Charges in an Electric Field

1. Go to the *SEPUP Third Edition Fields* page of the SEPUP website at www.sepuplhs.org/middle/third-edition. Follow your teacher’s instructions to open the simulation.
2. Locate the box in the upper right of the screen. Click the following:
ELECTRIC FIELD and
VOLTAGE (leave DIRECTION ONLY, VALUES, and GRID unchecked)
3. Use Student Sheet 2, “Modeling Charges,” to investigate the model. For each “Question,” follow the “What to do” and “What to look for” columns. Record your responses to the question on the Student Sheet.
4. In the last row of Student Sheet 2, come up with your own question to investigate using the simulation. Predict what you will observe based on the cause-and-effect relationships you have already noticed. Add your question, your procedure, and your observations to the Student Sheet when you run the simulation.
5. The simulation shows a model of an electric field. With your partner, first make a list of all the ways in which the simulation helps visualize an electric field. Then make a list of ways in which the model is not realistic.

Part B: Potential Energy in an Electric Field

6. Click the “restart button” in the lower right. Locate the box in the upper right of the screen and click the following:
VOLTAGE (leave ELECTRIC FIELD, VALUES, and GRID unchecked)
7. Place one positive charge on the screen. The brightness of the colored area around the charge represents the amount of potential energy of the charge. Observe the area around the charge.
8. Add a negative charge onto the screen. Move the charges around until the color for both charges is the brightest. In your science notebook, record the distance between the charges.
9. Remove the negative charge.
10. Repeat Step 8 with a positive charge.
11. Think about ways to increase the potential energy of an electric charge in an electric field.
12. Complete Student Sheet 1, and revise how you imagine an electric field.

ANALYSIS

1. Why was this exploration of electric charges presented as a computer model?
2. What were the strengths and limitations of the computer model for showing an electric field?
3. Imagine an electric field surrounding a stationary positive charge. If a negative charge was put somewhere in the field and released, which way would it move?
4. Imagine a negative charge and positive charge together in the same space. How can the space be electrically neutral with two charges in it?
5. What might cause the potential energy between two charges to increase? Use evidence from this activity to explain how it can be increased for
 - a. like charges.
 - b. opposite charges.