

Name:

Date:

PHYS 183 Determining Electric Field Relationships

Goal: Experimentally determine the E Filed vs. distance relationship for a variety of charge configurations.

Procedure: Open Charges and Field simulation <http://phet.colorado.edu/en/simulation/charges-and-fields> and click *Run Now*. Once the simulation opens, check the box next to *grid*.

- First, explore by placing a 1 nC positive charge and E-Field Sensor in the test area. Observe the sensor’s arrow as you drag it around the in the field. How does the arrow change as you move it around?

- Replace the positive charge with a negative charge. To remove charges, drag them back into their box. How does what the E-Field Sensor show differ with the negative charge? How is it the same?

Different:

Same:

- The E-Field Sensor represents a positive test charge and the arrow represents the force exerted by the E-field on the test charge.
- Determine the E vs. r relationship for the following charge configurations. This means making a hypothesis, taking data from the simulation, making a graph on Excel (or similar), finding the best-fit relationship.
- (Click on *show numbers* and *tape measure* to measure the distances from a field-creating charge to a test charge. The tape measure can be dragged to a specific distance and placed anywhere on the field.)

Scenario 1 hypothesis:

If

then

because

Scenario 2 hypothesis

If

then

because

Scenario 1: A single negative charge		Scenario 2: Above the center of a horizontal line of 45 positive charges	
r (m)	E (V/m or N/C)	r (m)	E (V/m or N/C)

Scenario 1 best fit relationship: _____

Theoretical support for this relationship:

Scenario 2 best fit relationship: _____

Theoretical support for this relationship:

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Scenario 3 hypothesis:

If _____
 then _____
 because _____

Scenario 4 hypothesis

If _____
 then _____
 because _____

Scenario 3: To the right of a negative and positive charge placed right next to each other on a horizontal line.		Scenario 4: Above a negative and positive charge placed right next to each other on a horizontal line	
r (m)	E (V/m or N/C)	r (m)	E (V/m or N/C)

Scenario 3 best fit relationship: _____
 Theoretical support for this relationship: _____

Scenario 4 best fit relationship: _____
 Theoretical support for this relationship: _____

Attach your graphs to this worksheet. Please put all graphs on a single sheet of paper. Make sure each graph is properly labeled with a sensible title and appropriate axes.

Discussion questions

- How did the E vs. r relationships differ for the different charge configurations?
- Coulomb's law states $F \propto r^{-2}$. Do your results for this activity refute Coulomb's Law? Why or why not?