PHYS 1112 Name(s):

Electric Field PhET Lab

**Purpose:**

In this lab you will investigate how a charge creates a field around itself, how test charges behave when placed in that field, and how the field various for different point charge distributions. Then you will apply these concepts to an Electric Field Hockey game.

**Procedure:**

1. Go the website <http://phet.colorado.edu/en/simulation/charges-and-fields> and click Run Now.
2. Type your answers directly into this document, which you will then submit to the Electric Field PhET Lab online dropbox in your course.
3. Place a 1 nC positive charge and E-field sensor in the test area. Click Show E-Field to observe the field lines and observe the sensor’s arrow as you drag it around in the field.
   1. What do you observe?
   2. Replace the positive charge with a negative charge (remove charges by dragging them back into their box). How does this change the electric field?
   3. By convention, field arrow point \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a positive charge and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a negative charge. As the sensor gets closer to a point charge, the field strength created by that field \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
4. Set up positive charge and a negative charge in the test area, along with an E-field sensor (Show E-field still on).
   1. Describe the electric field around this two-charge configuration (i.e. what would the electric field line configuration look like? Include references to direction and strength). You may want to include a screen shot.
   2. What happens if you move the charges closer together?
   3. What happens if you move the charges farther apart?
   4. Put another negative charge directly on top of the one that is already in the test area. How does this change the electric field in the test area?
   5. The basic law of electrostatics states that opposite charges will \_\_\_\_\_\_\_\_\_\_\_\_\_. How might this be supported by the electric field in the test area?
5. Set up positive charge and a positive charge in the test area, along with an E-field sensor (Show E-field still on).
   1. Describe the electric field around this two-charge configuration (i.e. what would the electric field line configuration look like? Include references to direction and strength). You may want to include a screen shot.
   2. What happens if you move the charges closer together?
   3. What happens if you move the charges farther apart?
   4. Put another positive charge directly on top of one that is already in the test area. How does this change the electric field in the test area?
   5. How would this electric field change if you replaced all of the positive charges with negative charges?
   6. The basic law of electrostatics states that like charges will \_\_\_\_\_\_\_\_\_\_\_\_\_. How might this be supported by the electric field in the test area?
6. Set up a configuration in the test area with at least 3 charges of any sign combination, along with an E-field sensor (Show E-field still on).
   1. Describe the configuration that you set up. You may want to include a screen shot.
   2. Describe the electric field of this configuration (i.e. what would the electric field line configuration look like? Include references to direction and strength). You may want to include a screen shot.
7. Open the Electric Field Hockey simulation at <http://phet.colorado.edu/en/simulation/electric-hockey> and click Run Now and play.
   1. Setup your charges and go for the goal (turning on the Field and Trace may make things a little easier).
   2. Reset the simulation to try again with your charges in place.
   3. Challenge other students to duels.
   4. Try to use less than 12 charges total (how few can you use?)

**Conclusion Questions and Calculations:**

1. Closer to a point charge, the electrostatic field created is *stronger / weaker*.
2. Placed exactly between two **oppositely** charged point charges, a test charge (the sensor) will show *zero /* *minimum / maximum* force (N) or field strength (N/C).
3. Placed exactly on a point charge, the sensor will show *zero / minimum / maximum* field strength.
4. The point charges used in the simulation are ± 1.0x10-9 C (**n**ano**C**oulomb). If two such positive charges are placed 2.0 m away from each other, the force between them would be... (use formula) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*SHOW WORK HERE:*

1. What is the magnitude of the electric field produced 2.0m away from **one** of the charges? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*WORK HERE:*

1. A test charge of 4.5 C in a field of strength 2.2 N/C would feel what force? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*WORK:*

1. A balloon is electrostatically charged with 3.4 μC (microcoulombs) of charge. A second balloon 23 cm away is charged with -5.1 μC of charge. The force of *attraction / repulsion* between the two charges will be:

*WORK:* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. If one of the balloons has a mass of 0.084 kg, with what acceleration does it move toward or away from the other balloon?

*WORK:*