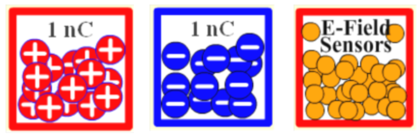
Name: ______________________________
Period: ________ Date: ___________________

DEVIL PHYSICS
BADDEST CLASS ON CAMPUS

PhET ELECTRIC FIELDS
(1/2 point each, 15 points total)

Introduction (1pt): It can by rationalized that the most important concept in physical science is like things _____________ while opposite things _____________. When working with static electric charges, like charges ____________ while opposite charges ___________. These charges can be as large as clouds of ionized gas in a nebula one million times the size of the earth, or as small as protons and electrons. The rule remains the same. In this lab, you will investigate how a charge creates a field around itself and how test charges behave when placed in that field.

Important Formulas: $F = Eq$ $F = k\frac{q_1 q_2}{d^2}$ $E = V/d$



$k = 9.00 \times 10^9\ Nm^2/C^2$

Procedure Part I:

- ***Go to http://phet.colorado.edu/en/simulation/charges-and-fields and select*** Run Now!
- Place a 1 nC (nanoCoulomb) positive charge and E-Field sensor in the test area. Click ☑ Show E-field to observe the field lines in the E-field. Observe the sensor's arrow as you drag it around the in the field.
- The sensor's arrow illustrates the **force** of attraction or repulsion at a point in an electric field.
- **(1pt)** Replace the positive charge with a negative point charge. To remove charges, drag them back into their box. By convention, field arrows point ______________ a positive charge and ______________ a negative charge. As the sensor gets closer to a point charge, the field strength created by that field _________________
- 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.
- When measuring field strength, click plot to show **lines of equipotential**.
- **(4pts)** Complete the table below using a single positive or negative charge:

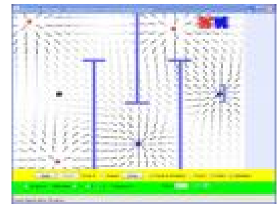
☑ Show numbers
☑ tape measure

Test charge distance, m	Field strength, V/m	Potential at location, V
1.0 m		
2.5 m		
	1.1 V/m	
4.0 m		

- Add at least three charges, using both positive and negative charges. Move the voltage meter around and *plot* the lines of equipotential. Plot at least ten lines. Show the value of the potential on each line of equipotential.
- **(4pts)** Sketch the multi-charge system in the box to the right or paste a screenshot of your field.

Procedure Part II: *http://phet.colorado.edu/en/simulation/electric-hockey*

Run Now!



Electric Field Hockey

- **(1pt)** So, using that wonderful principle that opposite charges __________ while like charges _________ play a little *Electric Field Hockey*.
- Setup your charges and go for the goal.
- Turning on the *Field* and *Trace* may make things a little easier.
- *Reset* the simulation to try again, with your charges in place.
- Challenge the other members of your lab group to duels.
- Challenge other lab groups. (no hockey fights please.)
- Try to use less than 12 charges total. (how few can you use?)
- **(4pts avg)** Paste a picture of your goal-scoring configuration in place of the box to the right. Scoring is as follows:
  - Level:
    - Level 1 – 1 point
    - Level 2 – 2 points
    - Level 3 – 3 points
  - Charges:
    - > 12 – 1 point
    - 7-12 – 2 points
    - 0-6 – 3 points

Paste a screen shot of your goal-scoring configuration using the least number of charges here.

Conclusion Questions and Calculations:

1. **(1pt)** Closer to a point charge, the electrostatic field created is *stronger / weaker*.
2. **(1pt)** 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. **(1pt)** Placed exactly on a point charge, the sensor will show *zero / minimum / maximum* field strength.
4. **(2pts)** The point charges used in the simulation are ± 1.0×10^{-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:

5. **(2pts)** What is the magnitude of the electric field produced 2.0m away from **one** of the charges?

   ____

   WORK HERE:

6. **(2pts)** A test charge of 4.5 C in a field of strength 2.2 N/C would feel what force? ________________

   WORK:

7. **(2pts)** What is the value of the electric field when a -9.6 V potential is found 1.4 m from its center?

   ____

   WORK:

8. **(2pts)** What is the electrostatic potential found **.**68 m from the center of a 2.3 V/m field? __________________

WORK:

9. **(2pts)** 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:

10. **(2pts)** 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:

The answers on this lab are a product of my own work and effort. Though I may have received some help in understanding the concepts and/or requirements, I did the work myself.

____

Student Signature
(for electronic submission, type student number in lieu of signature)

ROOM FOR IMPROVEMENT

APPLICABILITY: This lab is best suited for (check all that apply):

☐ Physics I Honors/ Pre-IB Physics ☐ IB Physics 2 ☐ IB Physics 3 ☐ None of These

Comments:

IMPROVEMENT: This lab can be improved by:

Comments:

When complete, either print a hardcopy and turn in or upload to ManageBac. Ensure your filename is "LastNameFirstinitialPerXLabName"