***DevilPhysics***

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Period: \_\_\_\_\_\_\_\_ Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***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:**   

k = 9.00 x 109 Nm2/C2

Procedure Part I:

* ***Go to*** [***http://phet.colorado.edu/en/simulation/charges-and-fields***](http://phet.colorado.edu/en/simulation/charges-and-fields) ***and select*******
* Place a 1 nC (nanoCoulomb) positive charge and E-Field sensor in the test area. Click  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  to show **lines of equipotential**.
* **(4pts)** Complete the table below using a single positive or negative charge:

|  |  |  |
| --- | --- | --- |
| **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*](http://phet.colorado.edu/en/simulation/electric-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.

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

* 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

**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 ± 1.0x10-9 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. **(2pts)** What is the magnitude of the electric field produced 2.0m away from **one** of the charges? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*WORK HERE:*

1. **(2pts)** A test charge of 4.5 C in a field of strength 2.2 N/C would feel what force? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*WORK:*

1. **(2pts)** What is the value of the electric field when a -9.6 V potential is found 1.4 m from its center? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*WORK:*

1. **(2pts)** What is the electrostatic potential found **.**68 m from the center of a 2.3 V/m field? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*WORK:*

1. **(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:*

1. **(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, print a hardcopy and turn in or e-mail electronic version to Mr. Smith @ [smithky@pcsb.org](mailto:smithky@pcsb.org)

Ensure your filename is “LastNameFirstinitialPerXLabName”