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

**Electric Field Exploration**

**Pre-Lab**

1. A large positive charge, +Q, is shown below when a small positive charge, +q, and a small negative charge, -q, is placed nearby. On the small positive charge and small negative charge, draw an arrow showing the direction of the force on each small charge. Explain your choices.



1. A large negative charge, -Q, is shown below when a small positive charge, +q, and a small negative charge, -q, is placed nearby. On the small positive charge and small negative charge,, draw an arrow showing the direction of the force on each small charge. Explain your choices.

**Set-Up**

* Go to the following website: http://phet.colorado.edu/simulations/sims.php?sim=Charges\_and\_Fields
* You should be at a webpage entitled “Charges and Fields”. If so, click Run Now.
* In the green box on the lower right, click the box for Show E-Field.

Part 1: Electric Field Around A Large Positive Charge

Drag one of the red positive charges from the upper right box and release it in the middle of the yellow box. You should notice many red arrows now surrounding the positive charge.

1. Sketch the arrangement of the arrows and the positive charge.

Each arrow represents the direction of the electric fieldat that point in space.

1. Why were there no arrows before you deposited the positive charge?

Click and hold on the positive charge and move it around. Observe the red arrows as you do this.

1. Complete the following sentence based on your observation: **No matter where the positive charge is located, the electric field arrows always point \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the positive charge.**

Now, click and drag one of the orange E-Field Sensors from the box and deposit it somewhere near the positive charge. You should now see a red arrow emerging from the orange E-Field Sensor. The length of this red arrow indicates the strengthof the electric field at that location. The direction of the red arrow indicates the directionof the electric fieldat that location. Move the sensor all around the positive charge and vary the distance from the positive charge.

1. What do you notice about the length of the red arrow on the sensor when it is close to the positive charge?
2. What do you notice about the length of the red arrow on the sensor when it is far away from the positive charge?
3. Complete the following sentence based on your observation: **The strength of the electric field \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as you move away from a positive charge and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ as you move towards it.**

Part 2: Electric Field Around a Negative Charge

Now click the red Clear All button. Drag one of the negative charges into the center and release it. You should again notice many red arrows surrounding the negative charge.

1. Sketch the arrangement of the arrows and the negative charge.

Click and hold on the negative charge and move it around. Observe the red arrows as you do this.

1. Complete the following sentence: **No matter where the negative charge is located, the electric field arrows always point \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the negative charge.**

Now, click and drag one of the orange E-Field Sensors from the box and deposit it somewhere near the negative charge.

1. What do you notice about the length of the red arrow on the sensor when it is close to the negative charge?
2. What do you notice about the length of the red arrow on the sensor when it is far away from the negative charge?
3. Complete the following sentence based on your observation: **The strength of the electric field \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as you move away from a negative charge and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ as you move toward a negative charge.**

Part 3: Electric Field Around Two Charges

Click Clear All. Place a positive and negative charge horizontal to each other.

1. Sketch the arrangement of the arrows around the negative and positive charges.

Click Clear All. Now place two positive charges horizontal to each other.

1. Sketch the arrangement of the arrows and the positive charges.

Click Clear All. Now place two negative charges horizontal to each other.

1. Sketch the arrangement of the arrows and the negative charges.
2. Do your pictures drawn above represent the conclusions you made about the direction of an electric field around a positive and negative charge (questions 3 & 8)? Explain why or why not.

**Conclusion/Analysis**

1. Compare your direction of the force on each small charge you drew in pre-lab question number 1 and 2 with your results to question 3 from part 1 and question 8 from part 2. Based on these answers, is the direction of the electric field determined by the direction a small positive charge would experience a force in an electric field or is it determined by the direction a small negative charge would experience a force in an electric field? Clearly explain your answer.
2. Determine the type of charge on each object below based on what you have learned about electric field. Explain your answers.

|  |  |  |
| --- | --- | --- |
|  |  |  |

1. A large charge is creating an electric field that is going to the right at a certain location in space.
   1. When a small positive charge is placed in this field, what direction will it experience a force? Explain. (*hint: use your answer to analysis question 1 to help you with this question)*
   2. When a small negative charge is placed in this same field, what direction will it experience a force? Explain.