Physics 200 Name: _____

Simulation: Electric Field Hockey

Open the Phet simulation: Electric Field Hockey. Turn on the field. Add some positive or negative charges and see how the positive puck moves.

1. What does a positive charge do when it passes over a field arrow that is pointing the same direction as the charge's motion?

The charge accelerates

2. How can you cause the positive puck to decelerate?

You can put a positive charge in its path (or you could try to position a negative charge behind it)

3. This simulation represents electric field with arrows, rather than lines.

   a. How do traditional electric field line drawings indicate a strong electric field?

Closer line proximity = stronger field.

   b. How does this simulation indicate a strong electric field?

Darkness of arrows. Darker arrows = stronger field

4. Enable "trace." When you set up a complicated array of charges on the hockey rink, the arrows seem to point out a path for the positive charge. In the beginning, the charge follows the path, but then it veers off.

   a. Does the charge veer off to the outside of the turn or to the inside?

   Outside

   b. Why does it veer off? Why doesn't the charge exactly follow the apparent path indicated by the arrows?

   The charged object has momentum (inertia). The field represents the direction in which the object is pushed – not the direction it will actually move. If you imagine a car traveling northward at a speed of 40mph, and you imagine a gust of wind suddenly pushing it directly westward, the car will not suddenly move directly westward. It will *accelerate* westward, meaning that it will veer a little to the west, but it will not turn directly westward. Similarly, if the particle in the simulation is moving rightward, and it reaches a position where the field lines point upward, it's momentum will continue to carry it to the right, although it will begin moving upward due to the upward push of the field.

   c. Which would you expect to veer off the path more severely, a more massive object or a less massive object – or neither (assuming the object charge is equal in both cases)? Try it. What happens, and why do you think it happens?

   When I do this, it seems to make no difference whether the object has high or low mass. On one hand, a larger mass object has more inertia, so it will be more likely to veer "off the path" in spite of the direction in which it is being pushed by the field. On the other hand, a lower mass object

will have more velocity, so it will have a lot of momentum, and will likewise be likely to veer off the path. I would have to think about this more to arrive at a more quantitative answer. But I'm not going to right now 😊

5. Optional: Try level 2 until you score a goal. How many tries did it take?