# Electric Field Hockey Lab

**(Adapted from a lab by Martha Lietz)**

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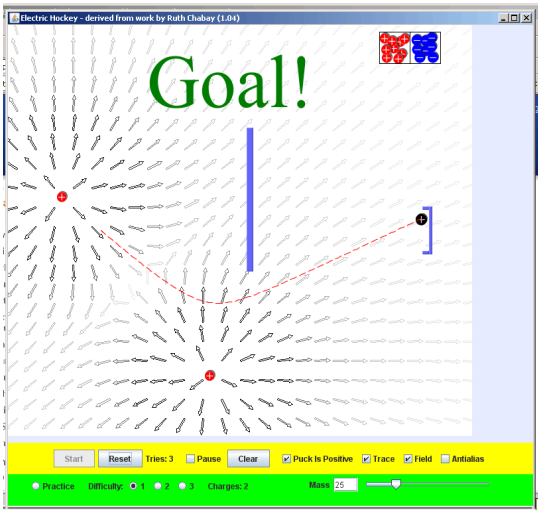
*Electric Field Hockey*, a Java applet by Ruth Chabay (published on the PhET website in Colorado), makes it possible for you to build your intuition and physical understanding concerning charge, forces between charges, electric fields, and the energy associated with electric charge. Basically, you use positive and negative charges to steer a charged "puck" around barriers and into a goal. I want you to play the game enough to get a good physical feel for the sometimes surprising ways in which the $1/r^2$ character of the electric interaction determines the motion of charged objects.




To the left is an example of one way to drive the charged puck into the net, using a couple of glued-down charges to steer the puck around the barrier in the center of the field (Level 1 difficulty).

Go to

https://phet.colorado.edu/en/simulations/category/physics/electricity-magnets-and-circuits . Then click on the "Run Now" button. It should open up the screen. Leave the puck positive. You can show field lines and the path that the puck takes if you want.

**STEP 1**: Play the game, going through Levels 1-3. Make a screen print of your solution for Level 3. Paste it into a Google Doc

**STEP 2**: Now try reducing the number of charges as possible (positive, negative or both). What is the minimum number of charges needed for each level? Add this screen print to your Word file for your final version of Level 2 and Level 3.

**STEP 3**: Answer the following questions in your Google Doc.

1. What general conclusions can you make regarding the interaction of electric charges with each other? For this question, list a conclusion, and then cite the evidence that you observed that suggests your conclusion is correct.
2. Energy can be stored in an object in many ways. For instance, an object that is moving has energy of motion stored within it (called kinetic energy, or KE). The greater its velocity, the more KE it has. In the simulation, what things can you do to insure the puck receives the maximum amount of KE possible? Assume your puck starts from rest (has no initial KE). List at least three different scenarios.
3. Suppose you have two positive charges of equal size (one being the puck). Is it possible in the simulation to arrange additional charge in such a manner so that the positive puck does not experience a force from a second positive charge? If so, what do you need to do? Give an example. A sketch might be easiest here, just be sure to explain it.
4. If you want a negative charge to move to the left, what are two things you can do to make this happen?
5. If you want the negative charge to move faster (i.e. to give it more energy), what can you do?
6. Now the tricky question, and it refers to the electrical circuits we will be working with much of the year. While charge certainly could exist in free space, we don't tend to see that in our normal daily lives (thank goodness!). Instead, we control electricity in circuits composed of metal wires and other metal conductors. Why do you think that is? Explain your thoughts. Hint: don't forget about what made a charge move in the simulation.

**STEP 4**: Submit your document and turn it in for grading.