Electric Field Part 3

Background
In the mid nineteenth century, Michael Faraday made a conceptual breakthrough and imagined "lines of force" somehow spreading out through space from a charged object. A second charged object then interacts with the lines of force; a charged object doesn't "know" about the existence of another charged object - it just knows that it is trapped in some lines of force. James Maxwell took those ideas and put them into mathematical form, and the idea of the *field* was born.

For this activity, you will sketch the *lines of force* or the *electric field* around a number of charge configurations by using the Phet simulation *Charges and Fields*, located at https://phet.colorado.edu/sims/charges-and-fields/charges-and-fields_en.html.

1. Draw the electric field around the following charges. In addition, move an "E-Field Sensors" around the charges and make note of the strength of the force and the direction of the force.

   a. Single Positive Charge

   b. Single Negative Charge

   c. Two Positive Charges

   d. Two Negative Charges

   e. Two Opposite Charges

   f. Four Charges!

2. a. How does the strength of the electric field relate to the density of the filed lines?

   b. Electric field lines go from _____ charges to _____ charges.

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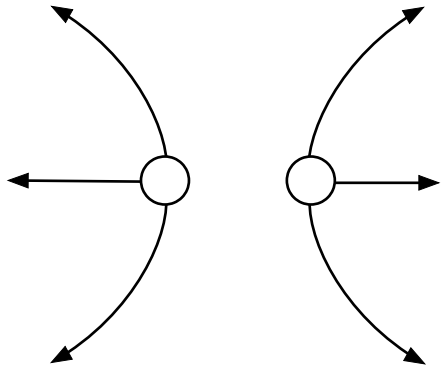
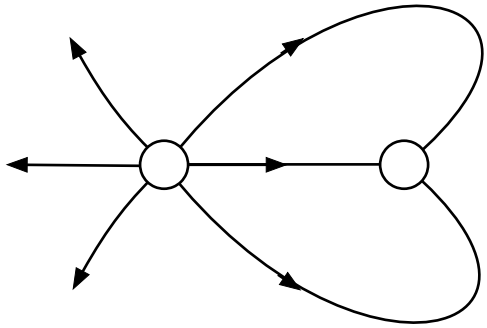
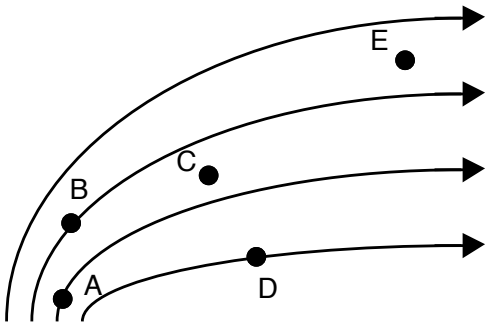
3. For the following diagrams, try and figure out the charges:

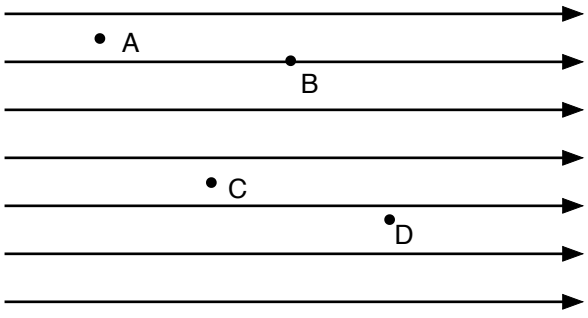




3. The diagram to the right represents a random electric field.
   a. At which point would the electric field be the greatest?
   b. At which point would the electric field be the least?
   c. At point B, draw an arrow that would represent the force on a proton placed at B.
   d. At point C, draw an arrow that would represent the force on an electron placed at C.



4. An electric field is shown below and to the right. If a proton were placed at point B, there would be a force of 3.2×10^{-16} N acting on it.
   a. How strong is the electric field at point B?
   b. Which way is the proton pushed at point B?
   c. If you put 3 protons at point B, instead of only one, what would be the force on them?
   d. What is the electric field at point C?



   e. If you put an electron at point D, what would be the force on it, and in what direction would the force be?
   f. The electric field shown is created by some arrangement of charges. Where would you likely find some positive charges? How about some negative charges?