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Electric Fields and Equipotentials

AP Physics C E&M

Objective: To describe the electric field of various charge configurations and to determine the motion of a charged particle placed in a uniform electric field. I will also learn how to explain and interpret electric field diagrams by creating electric fields using a computer simulation at https://phet.colorado.edu/sims/html/charges-and-fields/latest/charges-and-fields_en.html .

Procedure/Tasks

This lab is mostly investigative with some comparisons to simple charge configurations. You should start off by adding one point charge to the system (I recommend starting with 1 positive charge) and then gradually create a more complex charge distribution to help you answer the questions below. Please include your answers to the questions below and include screenshots of the charge configurations (including equipotential surfaces) you use in this lab.

The questions you are to answer are as follows:

1. How does the direction of the electric field relate to the equipotential curves? Can you describe a general direction for **E** relative to the surfaces?
   The direction of the electric field is perpendicular to the equipotential curves. The direction of the electric field relative to the surfaces is also perpendicular to the equipotential curves.
2. Does the magnitude of the electric field stay constant across an equipotential?
   No, it doesn't. The curve means the electric potential is constant. (V/m) same on every point of the curve.
3. How does the magnitude of the electric field vary with the magnitude of the potential at points, if at all?
   The less the potential is, the less electric field.
4. Can a closed equipotential surface enclose both positive and negative charges in it, or must it enclose charges of only one sign? Create a hypothesis on what the net charge must be for a surface if it can contain charges of both signs, or describe WHY an equipotential cannot enclose charges of opposite signs in it.
   It can enclose only one sign because it is a different direction of acceleration.
5. Based on the E-field vectors, to what values of potential will a positive charge want to accelerate toward (higher, lower, or 0)? Justify your answer.
   Anything Negative, because Positive attracts negative and negative charges have negative potential.

Postlab Questions

1. If you were to draw both equipotential surfaces and electric field vectors on the same diagram, use your findings to summarize how the drawing would look, including directions and how the lines/vectors would be oriented relative to each

other.
Electric field is constant on equipotential surfaces and electric potential is also constant at a certain equipotential curve.

2. Can 2 equipotential surfaces overlap? Why or why not?
   No, because equipotential surfaces are an ellipse with the same potential and there cannot be a another circle that has the same potential that is not the exact same ellipse as the first equipotential surface. No, because the vectors are different, so the charges are different, therefore the potential is not the same sign, so they cannot overlap.