Potential Surfaces Preliminary Lab

Physics

Electric potential difference tells us how much kinetic energy a charged particle will gain or lose as it moves in an electric field (provided it feels no forces other than those caused by the electric field). In a sense, electrical potential is the "right angle" to electric field vectors: places that have the same relative electrical potential in an electric field can be connected together to form "equipotential lines". The electric field vectors along these lines are always perpendicular to the lines.

The direction of the field vectors will always point away from areas in the electric field that have a stronger positive charge and towards areas that have a stronger negative charge. By convention, electrical potential is greater towards positive electric field sources. Therefore, positive particles will always accelerate towards areas of lower electrical potential and away from areas of higher electrical potential. Negative particles will always accelerate towards areas of higher electrical potential and away from areas of lower electrical potential.

Using the "Charges and Fields" applet, carry out the following tests and observations in order to further your understanding of electrical potential:

1. Place a +1 μC charge on the screen.
2. Click on "Voltage" on the menu. Red colors represent positive electrical potential; blue colors will represent negative electrical potential. Black regions are intermediate and closer to 0 electrical potential.
3. With your partners, discuss why it is that electrical potential (which is a relative measure of the difference in potential energy between two points) can be zero, or close to zero, within the field displayed on your screen. **In your notes, document your discussion.**
4. Using the crosshairs (one of the tools on the right-hand side of the screen), plot several equipotential lines (click on the pencil icon).
5. From the menu, select "Electric Field" and "Values".
6. With your partners, describe how the values of the equipotential lines change from point to point. Make sure that you can see how the electric field vectors are perpendicular to the field. **In your notes, document your understanding.**
7. Now, clear the equipotential lines you've drawn. Add several more charges (both positive and negative) to the screen. Then use the crosshairs to plot more equipotential lines.
8. With your partners, discuss how both a positive and negative particle would accelerate within the field that you've drawn. Make sure you can do the following (**document in your notes**):
    a. Calculate the electric field at any given point (both magnitude and direction) – you'll need the measurement tool to find "r" for any charge you've placed.
    b. Calculate the potential difference *between* any two points – again, you'll need to use the measurement tool to find "r".
    c. Estimate the path a particle (either positive or negative) would take through the field. Remember that the field vectors show net forces (and therefore indicate acceleration) rather than displacement or velocity.