PHYSICS 208

Electric Potential Lab

In this lab you are using PhET Charges and Fields Lab simulation:

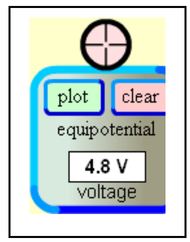
https://phet.colorado.edu/sims/html/charges-and-fields/latest/charges-and-fields_en.html

Intro

First, explore by placing a 1 nC positive point charge in the middle of the screen. Move the voltage probe box (shown to the right) to different locations near the charge.

How does the voltage number change?

How does the color in the circle with the cross-hairs change?



Replace the positive point charge with a negative point charge. To remove charges, drag them back into their box.

How does what the voltage probe box show differ with the negative charge?

How is it the same?

Electric potential is a characteristic of the distribution of source charge, the+/- 1 nC point charge in the examples above. The electric potential expresses the work a source charge distribution does on a point charge as the point charge's position changes.

The electric field expresses the force a source distribution exerts on a point charge and work done is proportional to force exerted. Thus, electric potential is related to electric field.

Can you use the Equipotential meter to determine the V vs. r relationship for a point charge?

PHYSICS 208

Electric Potential Lab

Place a single positive or negative point charge on the grid. Use the Equipotential meter to determine the maximum value of this charge by placing the crosshairs over the charge. Drag the tape across and measure a distance of three meters away from the center of your point charge. Now gather data from the simulation for radial distance (r) and associated voltage (V) using your grid and Equipotential meter respectively. Use Excel to make a graph and find the best fit relationship.

Relationship between Electric Field strength and Electric Potential

In this part of the activity, you are going to develop a procedure to test the relationship between electric potential and **E** field strength. In other words, when you make equipotential curves that have an equal ΔV between them, how does their spacing relate to **E** field?

First, explore by placing a 1 nC positive point charge in the middle of the screen. Move the voltage probe box to different locations near the charge and click *Plot*. Note that the electric potential is the same everywhere on each curve but different on different curves depending on how far the curve is from the 1 nC point charge. You can confirm this by moving the cross hairs of the voltage probe box around the curve and reading off the voltage value.

Next, use charges, the voltage probe box, tape measure, and **E** field sensors to determine the relationship between the strength of the electric field in a region and the spacing of equipotential curves. For example, for a given ΔV between curves, are the equipotential curves farther apart in a region of a strong E field compared to a weak one? Closer together? Is equipotential lines configuration independent of **E** field strength?