A small positive charge approaches a large, fixed positive charge as shown. Describe the motion of the small charge as a function of time. Try explaining the motion three different ways: using force, electric field, and potential energy. Sketch a graph of the following quantities as a function of time (all on the same graph): potential energy, kinetic energy, and total energy.

Repeat the analysis if the large, fixed charge is negative.

A 2.0-mm-diameter plastic bead is charged to -1.5 nC. An electron is fired at the bead from far away. Its closest approach to the plastic bead is 0.10 mm from the surface of the bead, at which point it reverses direction and heads back away from the bead along the same path. What was the electron’s initial speed?

A proton moves along the path shown at right, passing through points c and d. The proton’s speed at point c is $8.0 \times 10^7$ m/s. What will be its speed at point d?
Worksheet Problem #5

The graph below shows the electrical potential along the x-axis. (a) Draw the corresponding potential energy diagram for a -20 nC charge particle that moves in this potential. (b) If the particle is shot in from the right (xi > 12 cm) with an initial kinetic energy of 1 μJ, determine the value of x for which the particle has its maximum speed; the kinetic energy at that point; the turning point; and the force at the turning point.

Worksheet Problem #6

Given the graph of potential below, sketch the corresponding graph of the x-component of the electric field.

Worksheet Problem #7

Given the graph of the x-component of the electric field below, sketch the corresponding graph of the potential.
An equipotential surface is a locus of points in an electric field that are all at the same electrical potential. An example is the locus of points equi-distant from an isolated point charge (a sphere).

Notice that the equipotential surfaces are **perpendicular** to the electric field lines everywhere!

Remember the electric field only performs work on a charge when the charge moves parallel to the electric field lines.

So no work is done by the electric field as a charge moves along an equipotential surface.

This is just like GRAVITY, right?

By definition, the potential difference between any two points on an equipotential surface \( (V_b - V_a) \) must be...

\[
W = -q\Delta V
\]

Conductors

\[
\Delta V = -\varepsilon d = 0
\]

Remember that the electric field is everywhere perpendicular to the surface of a conductor, and is zero inside of a conductor.

From the surface of a conductor throughout its entire interior, the electric field is 0 when the conductor is in electrostatic equilibrium.

When in electrostatic equilibrium (i.e., no charges are moving around), all points on and inside of a conductor are at the same electrical potential!