

NYU Physics 2 — Problem Set 3

Due by Friday 2002 February 15 at 1pm at Irene Port's office in Meyer 424.

Problem 1

A cylindrical, high-tension wire of radius 2 cm is held at an electrostatic potential difference of 10^4 V relative to the ground. It is suspended at a height of 50 m from the ground. What is the magnitude E of the electric field right at the surface of the wire? How small can the radius of the wire be made before the air breaks down around it? State any assumptions you make in getting your answers.

Problem 2

A thin, flat plane with surface charge density σ is inserted between two large, flat, conducting, parallel plates. Both the plane and the plates are normal to the x direction, with the charged plane defined to be at $x = 0$. One conducting plate is at $x = -x_1$ and the other is at $x = x_2$. What is the electric field everywhere between the two plates if the two plates are connected by a conducting wire, as shown in lecture? You will have to use Gauss's law, the symmetry of the problem, and the fact that the surface of a conductor is an equipotential. Assume that the plates and plane are all large enough that they can be treated as "infinite" and the edges can be ignored.

Problem 3

Consider a thin, square, charged plate of metal in the x - y plane. Sketch the equipotentials and field lines in the x - y plane, noting explicitly on your diagram whatever you can about the shape and density of field lines and equipotential lines.