Physics 110a Fall 2004 Prof. Orenstein

Quiz #1: Two questions, each has three parts. Each part is worth 20 points, making a total possible score of 120 points.

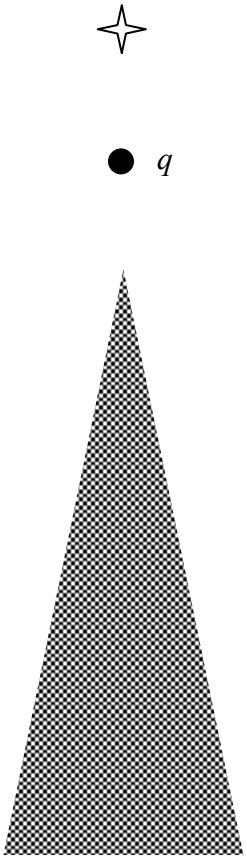
Problem 1

Consider a point charge +q that is suspended above the apex of a wedge-shaped conductor, as shown below. (The star in the drawing is not a charge. It denotes a point in space referred to in last part of this problem).

a) Make a sketch of the electric field lines, with enough detail to illustrate the main features of the field.

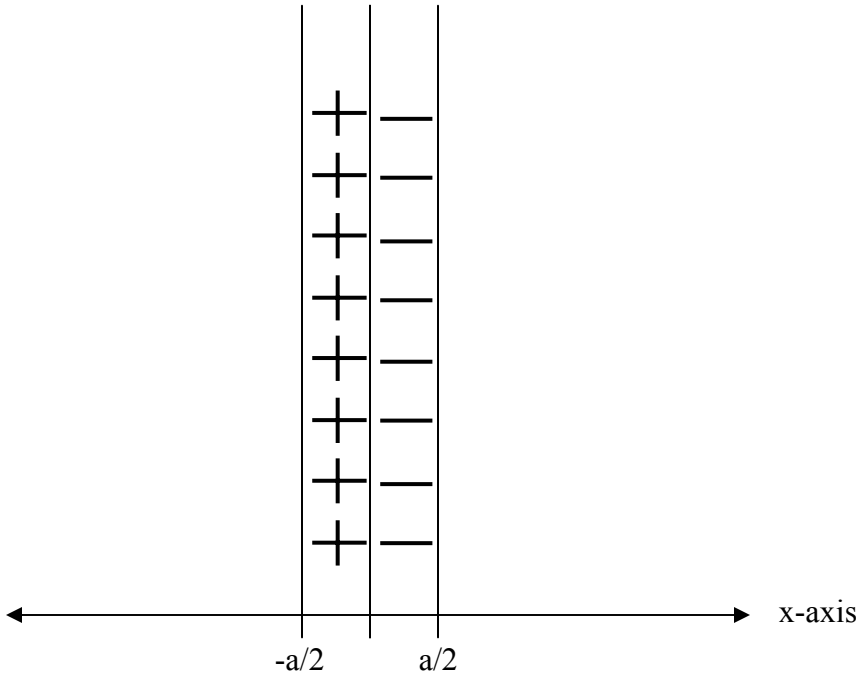
b) Is the point charge (i) attracted to apex of the wedge, (ii) repelled, or (iii) neither.

c) Consider the work required to bring another charge q from infinity to the point in space indicated by the star, with the other charge and the conductor held fixed. Is this amount of work (i) greater, (ii) lesser, or (iii) the same as the work required if the conductor were not there [you need not calculate the work, just argue on prinicple].



Problem 2:

Consider a thin layer of positive charge in contact with a thin layer of negative charge, as shown in the sketch below:



The thickness of each layer is a/2. The charge density in the positive layer is ρ and the charge density in the negative layer is - ρ. Assume the layers are perfectly flat and infinite in their lateral dimensions.

a) Find the electric field (magnitude and direction) everywhere in space. Make a sketch of E as a function of x to illustrate your answer.

b) Find the potential everywhere in space.

c) How much work is required to move a small positive test charge q from the right to the left of the bilayer?