

Home Work Set # 9, Physics 217, Due: November 14, 2001

Problem 1

An electric dipole \vec{p} , pointing in the y direction, is placed midway between two large conducting plates, as shown in Figure 1. Each plate makes a small angle θ with respect to the x axis, and they are maintained at potentials $\pm V$. What is the direction of the net force on \vec{p} ? Explain!

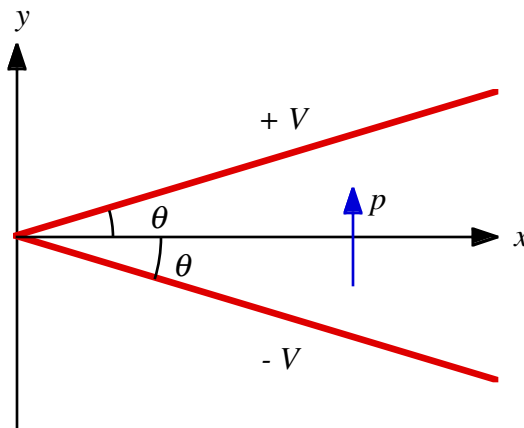


Figure 1. Problem 1.

Problem 2

A point charge q is embedded at the center of a sphere of linear dielectric material (with susceptibility χ_e and radius R).

- Find the electric field, the polarization and the bound charge.
- What is the total bound charge on the surface?
- Where is the compensating negative bound charge located?

Problem 3

At the interface between one linear dielectric and another linear dielectric the electric field lines bend (see Figure 2). Show that $\tan\theta_2/\tan\theta_1 = \epsilon_2/\epsilon_1$, assuming that there is no *free* charge at the boundary.

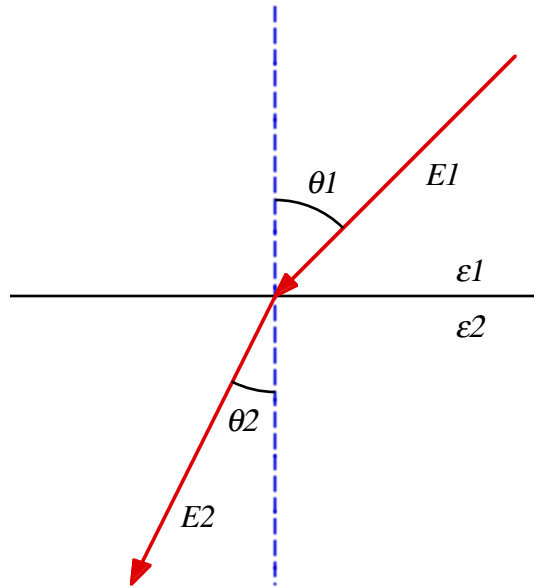


Figure 2. Problem 3.

Problem 4

- a) Find the force on a square loop placed as shown in Figure 3a, near an infinite straight wire. Both the loop and the wire carry a steady current I .
- b) Find the force on a triangular loop placed as shown in Figure 3b, near an infinite straight wire. Both the loop and the wire carry a steady current I .

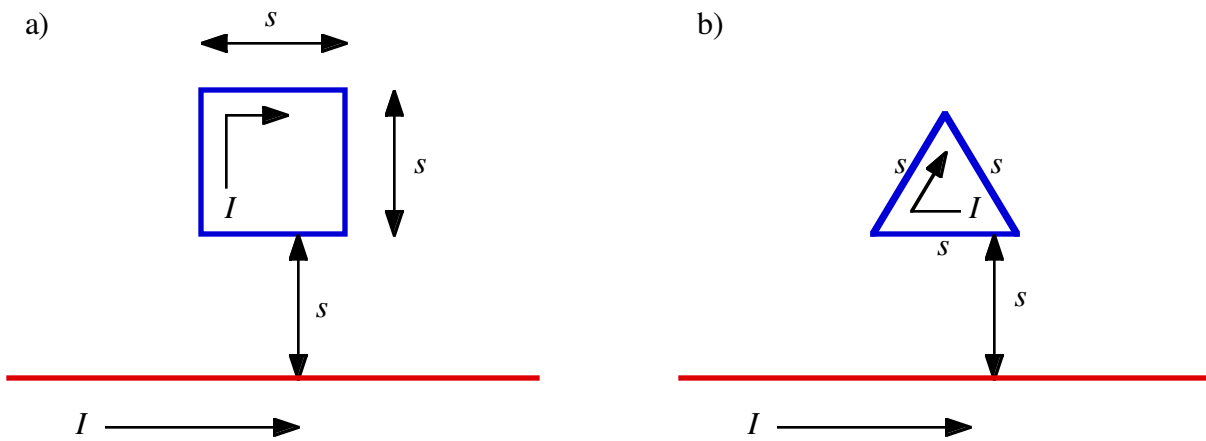


Figure 3. Problem 4.

Problem 5

Suppose the magnetic field in some region has the form

$$\vec{B} = kz\hat{i}$$

where k is some constant. Find the force on a square loop of side s , lying in the yz plane, centered at the origin, which carries a current I .