Exam 1, Phys208 **October 8, 2004**

Name: _____

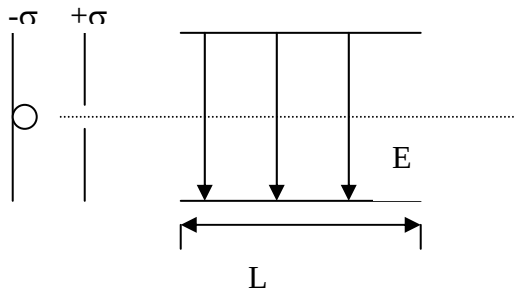
Please give me a word or number to post your grade_____

1. (35 pts) Two large parallel plates carry opposite charges with surface charge density of -σ and +σ, respectively.

(a) (10 pts) Use Gauss' law to calculate the electric field between the plates (need show your work, just write down the answer is not going to earn any credits).

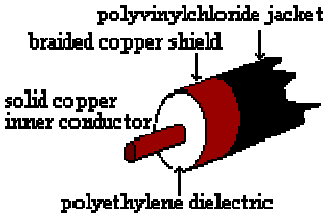
(b) (10 pts) If a negative charge q was released from still at the negatively charged plate and accelerated to the positively charged plate. Assuming *d* is the separation between two plates, what is the velocity of the charge *q* when it reaches the positively charged plate?

(c) (15pts) If there is a hole on the positively charged plate and the charge *q* enters another electric field *E* shown in the following Fig. Calculate the position of the electron (with respect to its original path) after it exits *E* field, The mass of the charge *q* is *m.*



2. (30pts) Coaxial cable is typically used to make high-speed circuit connections between electronic test instruments. It consists of an inner wire of diameter *a*, a concentric conducting braid of diameter *b*, separated by an insulating material. This is a capacitor geometry for which you may calculate its capacitance using Gauss's law.

a. (15pts) Use Gauss's law to determine the electric field at a point between long coaxial conductors when oppositely charged with a linear charge density λ (C/m). Sketch the field and gaussian surface; say a few words about the symmetry of the field and the selection of gaussian surface.
(The region between the conductors may be assumed to be empty here.)



RG-58/U coaxial cable

b. (15 pts) Use the resulting electric field to find the potential difference between two conductors *(The region between the conductors may be assumed to be empty here.).*

3 (35pts) An ***insulating*** sphere of radius R_1 is placed at the center of a ***conducting*** spherical shell of inner and outer radii of R_2 and R_3. The insulating sphere carries q_1 which is uniformly distributed over the sphere. The conducting shell carries charge q_2.
(1) (5pts) Calculate E(r) at $r>R_3$.
(2) (2 pts) Calculate E(r) inside the conducting shell.
(3) (3 pts) Calculate E(r) at $R_2 > r>R_1$.
(4) (10 pts) Calculate E(r) inside the insulating sphere.
(5) (10 pts) Calculate the potential difference between the surface of the insulating sphere and the conducting sphere.
(6) (5pts) What are the charges on the inner and outer surfaces of the conducting spherical shell.