

# PHY 322: Electromagnetic Fields - Fall 2004

## Midterm I

October 6, 2004

Please print your name here:

For the grader:

Problem 1	
Problem 2	
Total	

**Problem 1:***(10 points)*

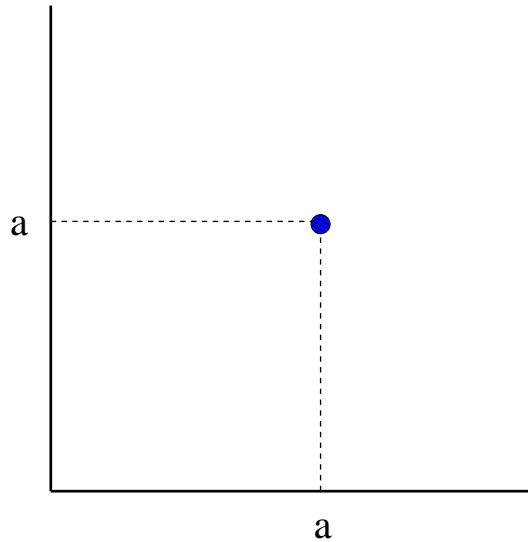
A long coaxial cable carries a uniform *volume* charge density  $\rho$  on the inner cylinder (radius  $a$ ), and a uniform *surface* charge density on the outer cylindrical shell (radius  $b$ ). This surface charge density is negative and of just the right magnitude so that the cable as a whole is electrically neutral.

- (i) Find the electric field  $\vec{\mathbf{E}}$  inside the inner cylinder ( $r < a$ ).
- (ii) Find  $\vec{\mathbf{E}}$  between the cylinders ( $a < r < b$ ),
- (iii) Find  $\vec{\mathbf{E}}$  outside the cable ( $r > b$ ).
- (iv) Plot  $|\vec{\mathbf{E}}|$  as a function of  $r$ .

**Problem 2:**

*(10 points)*

Two large conducting plates meet at  $90^\circ$ , as shown in the figure. A charge  $Q$  is placed on the center line of the region between the plates, at a distance  $a$  from each plate.



- (a) Find the electrostatic potential in the region between the plates.
- (b) Find the force on the charge.
- (c) Find the work needed to bring  $Q$  from infinity to the location shown.