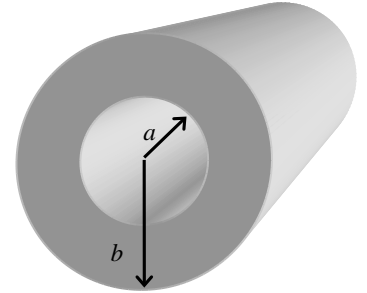


Physics 2135

Special Homework Assignment #3

An infinitely long **insulating** cylindrical shell has an inner radius a , an outer radius b , and an unknown **uniform** positive charge density ρ (charge per unit volume) distributed in the region between $r = a$ and $r = b$.

(a) Using Gauss's law, find the electric field in the hollow inner region $r < a$. Begin with a statement of Gauss's Law and justify all steps leading to your answer.



(b) Suppose the electric field at the outer edge of the cylindrical shell (i.e., at $r = b$) is measured, and is found to have a magnitude of E_0 . Use Gauss's law to express the charge density ρ in terms of the quantities E_0 , a , b , and any fundamental constants you may need. Leave your answer in symbolic form.

(c) Find the magnitude E of the electric field at a radial distance $a < r < b$ from the center of the cylindrical shell. Express your answer in terms of fundamental constants and some combination of a , b , r , E_0 , and/or ρ .