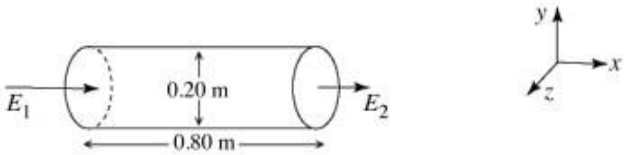
D1

A nonuniform electric field is directed along the *x*-axis at all points in space. This magnitude of the field varies with *x*, but not with respect to *y* or *z*. The axis of a cylindrical surface, 0.80 m long and 0.20 m in diameter, is aligned parallel to the *x*-axis, as shown in the figure. The electric fields E_1 and E_2, at the ends of the cylindrical surface, have magnitudes of 8000 N/C and 3000 N/C respectively, and are directed as shown. ($\varepsilon_0 = 8.85 \times 10^{-12}\ C^2/N \cdot m^2$) The charge enclosed by the cylindrical surface is?



D2

A nonuniform, but spherically symmetric, distribution of charge has a charge density $\rho(r)$ given as follows:

$$\rho(r) = \rho_0\left(1 - \frac{4r}{3R}\right) \quad for\ r \le R$$

$$\rho(r) = 0 \quad for\ r > R$$

Where ρ_0 is a positive constant. (a) Find the total charge contained in the charge distribution. (b) Obtain an expression for the electric field in the region $r > R$. (c) Obtain an expression for the electric field in the region $r \le R$. (d) Graph the electric-field magnitude E as a function of r. (e) Find the value of r at which the electric field is maximum, and find the value of that maximum field.

D3

A small particle has charge -5.00 μC and mass $2.00 \times 10^{-4} kg$. It moves from point A, where the electric potential is $V_A = +200V$, to point B, where the electric potential is $V_A = +800V$. The electric force is the only force acting on the particle. The particle has speed 5.00 m/s at point A. What is its speed at point B? Is it moving faster or slower at B than at A? Explain.