

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

$$\begin{aligned}\rho(r) &= \rho_0 (1 - r/R) & \text{for } r \leq R \\ \rho(r) &= 0 & \text{for } r \geq R\end{aligned}$$

where  $\rho_0 = 3Q/\pi R^3$  is a positive constant. (a) Show that the total charge contained in the charge distribution is  $Q$ . (b) Show that the electric field in the region  $r \geq R$  is identical to that produced by a point charge  $Q$  at  $r = 0$ . (c) Obtain an expression for the electric field in the region  $r \leq R$ . (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.