

46. (a) From Gauss' law,

$$\vec{E}(\vec{r}) = \frac{1}{4\pi\epsilon_0} \frac{q_{\text{encl}}}{r^3} \vec{r} = \frac{1}{4\pi\epsilon_0} \frac{(4\pi\rho r^3/3)\vec{r}}{r^3} = \frac{\rho}{3\epsilon_0} \vec{r} .$$

(b) The charge distribution in this case is equivalent to that of a whole sphere of charge density ρ plus a smaller sphere of charge density $-\rho$ which fills the void. By superposition

$$\vec{E}(\vec{r}) = \frac{\rho\vec{r}}{3\epsilon_0} + \frac{(-\rho)(\vec{r} - \vec{a})}{3\epsilon_0} = \frac{\rho\vec{a}}{3\epsilon_0} .$$