

**Problem 4.8.** Show that the interaction energy of two ideal dipoles separated by a displacement  $\mathbf{r}$  is

$$U = \frac{1}{4\pi\epsilon_0} \frac{1}{r^3} [\mathbf{p}_1 \cdot \mathbf{p}_2 - 3(\mathbf{p}_1 \cdot \hat{\mathbf{r}})(\mathbf{p}_2 \cdot \hat{\mathbf{r}})]. \quad (4.7)$$

[Hint: Use [Prob. 4.7](#) and Eq. [3.104](#).]

**Problem 4.10.** A sphere of radius  $R$  carries a polarization

$$\mathbf{P}(\mathbf{r}) = k\mathbf{r},$$

where  $k$  is a constant and  $\mathbf{r}$  is the vector from the center.

- (a) Calculate the bound charges  $\sigma_b$  and  $\rho_b$ .
- (b) Find the field inside and outside the sphere.