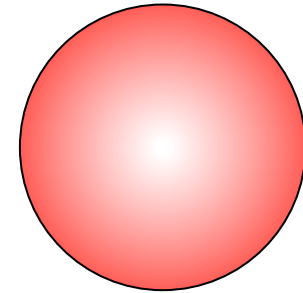


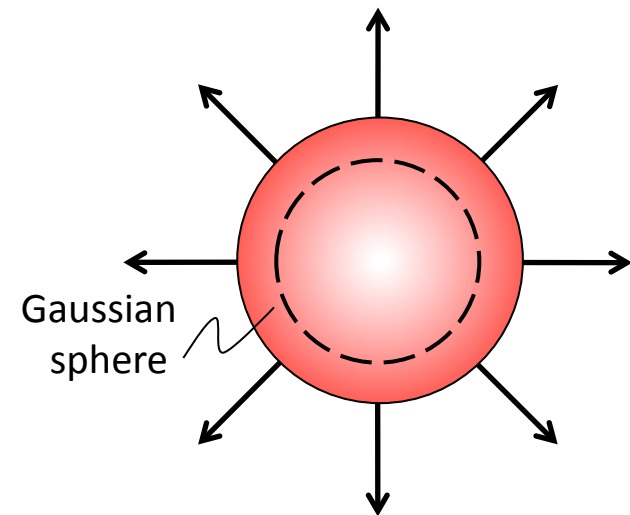
Problem 24.27

A 14 cm sphere has a charge equal to $3.2 \mu\text{C}$ on its surface.



a.) Derive an expression for the E-fld at $r = 10 \text{ cm}$.

$$\int_A \vec{E} \cdot d\vec{A} = \frac{q_{\text{enclose}}}{\epsilon_0}$$
$$\int_A E dA \cos 0^\circ = \frac{82q_{\text{proton}}}{\epsilon_0}$$
$$\Rightarrow E = 0$$



b.) Derive an expression for the E-fld at $r = 20 \text{ cm}$.

$$\int_A \vec{E} \cdot d\vec{A} = \frac{q_{\text{enclose}}}{\epsilon_0}$$

$$\int_A |\vec{E}| |d\vec{A}| \cos 0^\circ = \frac{q_{\text{surface}}}{\epsilon_0}$$

$$\Rightarrow E \int_A dA = \frac{q_{\text{surface}}}{\epsilon_0}$$

$$\Rightarrow E(4\pi R^2) = \frac{q_{\text{surface}}}{\epsilon_0}$$

$$\Rightarrow E = \frac{1}{4\pi\epsilon_0} \frac{q_{\text{surface}}}{R^2}$$

$$\Rightarrow \mathbf{E} = \left(9 \times 10^9 \text{ N} \cdot \text{m}^2 / \text{C}^2\right) \frac{(3.2 \times 10^{-6} \text{ C})}{(.2 \text{ m})^2}$$
$$= 7.2 \times 10^5 \text{ N/C}$$

