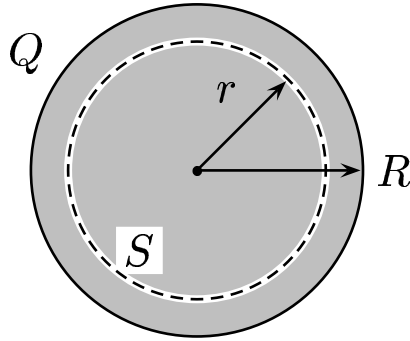


A sphere (insulator) has a uniform charge Q and radius R . Its charge density is therefore $\rho = \frac{Q}{V}$.



Construct a Gaussian surface S having concentric spherical surface with radius r .

Determine the magnitude of the electric field E at the Gaussian surface S .

- A) $\|\vec{E}\| = \frac{4\rho}{3\epsilon_0} r^3$ B) $\|\vec{E}\| = \frac{2\rho}{3\epsilon_0} r$
C) $\|\vec{E}\| = \frac{1\rho}{2\epsilon_0} r^2$ D) $\|\vec{E}\| = \frac{1\rho}{3\epsilon_0} r$
-

For an electrostatic case, the charge(s) inside of a conductor. The volume of a sphere is $V = \frac{4}{3} \pi r^3$.

$$Q_{inside} = \rho V = \rho \frac{4}{3} \pi r^3, \quad \text{so}$$

$$\begin{aligned} E &= \frac{1}{4\pi\epsilon_0} \frac{Q_{inside}}{r^2} \\ &= \frac{1}{4\pi\epsilon_0} \frac{4\pi r^3 \rho}{3r^2} \\ &= \frac{1}{3} \frac{\rho r}{\epsilon_0}. \end{aligned}$$

Answer **D**.