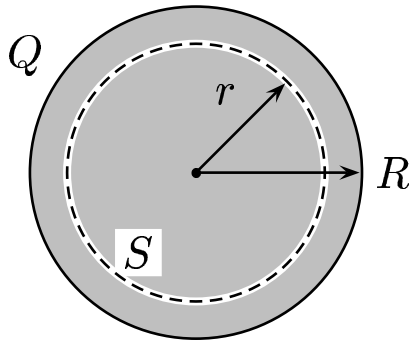
A sphere (insulator) has a uniform charge Q and radius R. Its charge density is therefore $\rho = \dfrac{Q}{V}$.



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) $\|\vec{E}\| = \dfrac{4\,\rho}{3\,\epsilon_0}\, r^3$

B) $\|\vec{E}\| = \dfrac{2\,\rho}{3\,\epsilon_0}\, r$

C) $\|\vec{E}\| = \dfrac{1\,\rho}{2\,\epsilon_0}\, r^2$

D) $\|\vec{E}\| = \dfrac{1\,\rho}{3\,\epsilon_0}\, r$

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

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

$$E = \frac{1}{4\,\pi\,\epsilon_0}\,\frac{Q_{inside}}{r^2}$$

$$= \frac{1}{4\,\pi\,\epsilon_0}\,\frac{4\,\pi\,r^3\,\rho}{3\,r^2}$$

$$= \frac{1}{3}\,\frac{\rho\,r}{\epsilon_0}\,.$$

Answer **D**.

24.03-04˙Uniformly˙Charged˙Sphere 2004-3-24