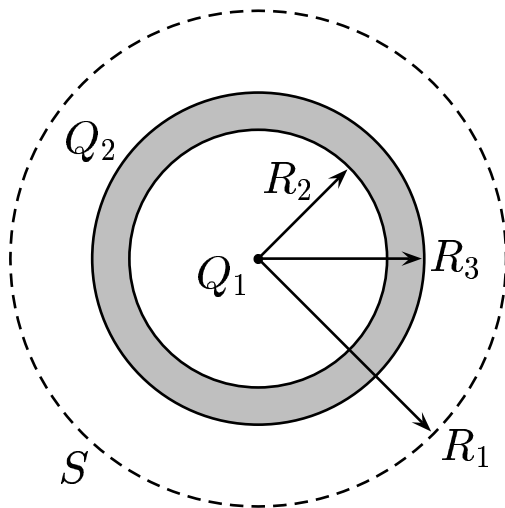


A point charge $Q_1 > 0$ is located at the center of a hollow thick spherical shell (made of an insulating material) that has an inner radius of R_2 and an outer radius of R_3 . The net charge on the shell is Q_2 and the charge is uniformly distributed throughout the shell. Let S (dashed circular line) be a concentric spherical surface (Gaussian surface) with a radius R_1 .



Find E_1 , the magnitude of the radial electric field vector at the surface of the Gaussian surface S , which is a distance R_1 from the center of the spherical conducting shell.

A) $\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{Q_1}{R_1^2}$

B) $\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{Q_2}{R_1^2}$

C) $\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{Q_1 + Q_2}{R_1^2}$

Since the charge distribution is spherically symmetric, $\|\vec{E}\|$ must be the

same everywhere on S . And by symmetry \vec{E} must be directed radially, either outward or inward. However there is a charge enclosed in the Gaussian sur-

face, therefore $\Phi_S = \oint_S \vec{E} \cdot \vec{A} = \frac{Q_1 + Q_2}{\epsilon_0}$, or specifically $\vec{E} = \frac{1}{4\pi\epsilon_0} \frac{Q_1 + Q_2}{R_1^2}$.

Answer **C**.

24.03-07 Charged Spherical Shell 2006-9-14