

Calculating Total Charge

For each case below, find the total charge. What are the dimensions of the constants α and k ? (If the total charge is infinite, what should you calculate instead to provide meaningful information?)

1. A positively charged (dielectric) spherical shell of inner radius a and outer radius b with a spherically symmetric internal charge density $\rho(r) = \alpha r^3$
2. A positively charged (dielectric) spherical shell of inner radius a and outer radius b with a spherically symmetric internal charge density $\rho(r) = 3\alpha e^{(kr)^3}$
3. A positively charged (dielectric) spherical shell of inner radius a and outer radius b with a spherically symmetric internal charge density $\rho(r) = \alpha \frac{e^{(kr)}}{r^2}$
4. A positively charged (dielectric) cylindrical shell of inner radius a and outer radius b with a cylindrically symmetric internal charge density $\rho(r) = \alpha r^3$
5. A positively charged (dielectric) cylindrical shell of inner radius a and outer radius b with a cylindrically symmetric internal charge density $\rho(r) = 3\alpha e^{(kr)^2}$
6. A positively charged (dielectric) cylindrical shell of inner radius a and outer radius b with a cylindrically symmetric internal charge density $\rho(r) = \alpha \frac{e^{(kr)}}{r}$