Calculating Total Charge

Each group will be given one of the charge distributions given below: (α and k are constants with dimensions appropriate for the specific example.)

- Spherical Symmetery
  1. A positively charged (dielectric) spherical shell of inner radius a and outer radius b with a spherically symmetric internal charge density $\rho(\vec{r}) = \alpha\, r^3$
  2. A positively charged (dielectric) spherical shell of inner radius a and outer radius b with a spherically symmetric internal charge density $\rho(\vec{r}) = \alpha\, e^{(kr)^3}$
  3. A positively charged (dielectric) spherical shell of inner radius a and outer radius b with a spherically symmetric internal charge density $\rho(\vec{r}) = \alpha\, \frac{1}{r^2}\, e^{(kr)}$
- Cylindrical Symmetry
  1. A positively charged (dielectric) cylindrical shell of inner radius a and outer radius b with a cylindrically symmetric internal charge density $\rho(\vec{r}) = \alpha\, s^3$
  2. A positively charged (dielectric) cylindrical shell of inner radius a and outer radius b with a cylindrically symmetric internal charge density $\rho(\vec{r}) = \alpha\, e^{(ks)^2}$
  3. A positively charged (dielectric) cylindrical shell of inner radius a and outer radius b with a cylindrically symmetric internal charge density $\rho(\vec{r}) = \alpha\, \frac{1}{s}\, e^{(ks)}$

For your group's case, answer the following questions:

1. Find the total charge. (If the total charge is infinite, decide what you should calculate instead to provide a meaningful answer.)
2. Find the dimensions of the constants α and k.