Answer on Question #43095-Physics-Electromagnetism

A solid metallic sphere of radius a carries total charge Q. No other charges are nearby. The electric field just outside its surface is kQ/a^2 radially outward. At this close point the uniformly charged surface of the sphere looks exactly like a uniform flat sheet of charge. Is the electric field here given by σ/ε or σ/2ε?

How come it is not σ/2ε since it is a sheet of charge?

Solution

The electric field just outside its surface is

$$E = \frac{kQ}{a^2},$$

where a is a radius of sphere, Q is a charge of sphere, $k = \frac{1}{4\pi\varepsilon_0}$.

The electric field is

$$E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{a^2} = \frac{1}{\varepsilon_0}\cdot\frac{Q}{S} = \frac{\sigma}{\varepsilon_0},$$

where $S = 4\pi a^2$ is an area of sphere, $\sigma = \frac{Q}{S}$ is a surface charge density.

Answer: $\frac{\sigma}{\varepsilon_0}$.