319.

Problem 29.16 (RHK)

$E = \sigma/\varepsilon_0$ gives the electric field at points near a charged conducting surface. By applying this equation to a conducting sphere of radius r, carrying charge q on its surface, we will show that the electric field outside the sphere is the same as the field of a point charge at the position of the centre of the sphere.

Solution:

We will use the result that the electric field at points near the surface of a charged conductor is given by

$$E = \sigma/\varepsilon_0 \ .$$

Let us consider a conducting sphere of radius *r*, carrying a charge *q* on its surface. The surface charge density on the conducting sphere will be

$$\sigma = \frac{q}{4\pi r^2} \ .$$

By using the result $E = \sigma/\varepsilon_0$, we note that the electric field at points near the surface of the spherical conductor will be

$$E = \frac{q}{4\pi\varepsilon_0 r^2} \ .$$

This is the same as the electric field outside the sphere of radius r due to a point charge q located at the centre.