

**Answer on Question #62337, Physics / Electromagnetism**

How do you find the electric field from a hollow uniformly charged sphere

**Solution:**

Gauss's flux theorem:

$$\Phi_E = \frac{Q}{\epsilon_0} \quad (1),$$

where  $\Phi_E$  is the electric flux through a closed surface  $S$  enclosing any volume  $V$ ,  $Q$  is the total charge enclosed within  $S$ , and  $\epsilon_0$  is the electric constant.

The electric flux  $\Phi_E$  is defined as a surface integral of the electric field:

$$\Phi_E = \oint_A \mathbf{E}(\mathbf{r}) \cdot d\mathbf{A} \quad (2),$$

where  $\mathbf{E}$  is the electric field,  $d\mathbf{A}$  is infinitesimal element of area of the surface

Of (2)  $\Rightarrow$  for sphere:

$$\Phi_E = E(r) 4\pi r^2 \quad (3),$$

where  $r$  is a radius of the sphere

$$(3) \text{ in } (1): E(r) 4\pi r^2 = \frac{Q}{\epsilon_0} \quad (4)$$

$$\text{Of } (4) \Rightarrow E(r) = \frac{Q}{4\pi\epsilon_0 r^2}$$

**Answer:**

$$E(r) = \frac{Q}{4\pi\epsilon_0 r^2}$$