

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 Φ_E is the electric flux through a closed surface S enclosing any volume V , Q is the total charge enclosed within S , and ϵ_0 is the electric constant.

The electric flux Φ_E is defined as a surface integral of the electric field:

$$\Phi_E = \oint_A E(r) dA \quad (2),$$

where E is the electric field, dA 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:

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