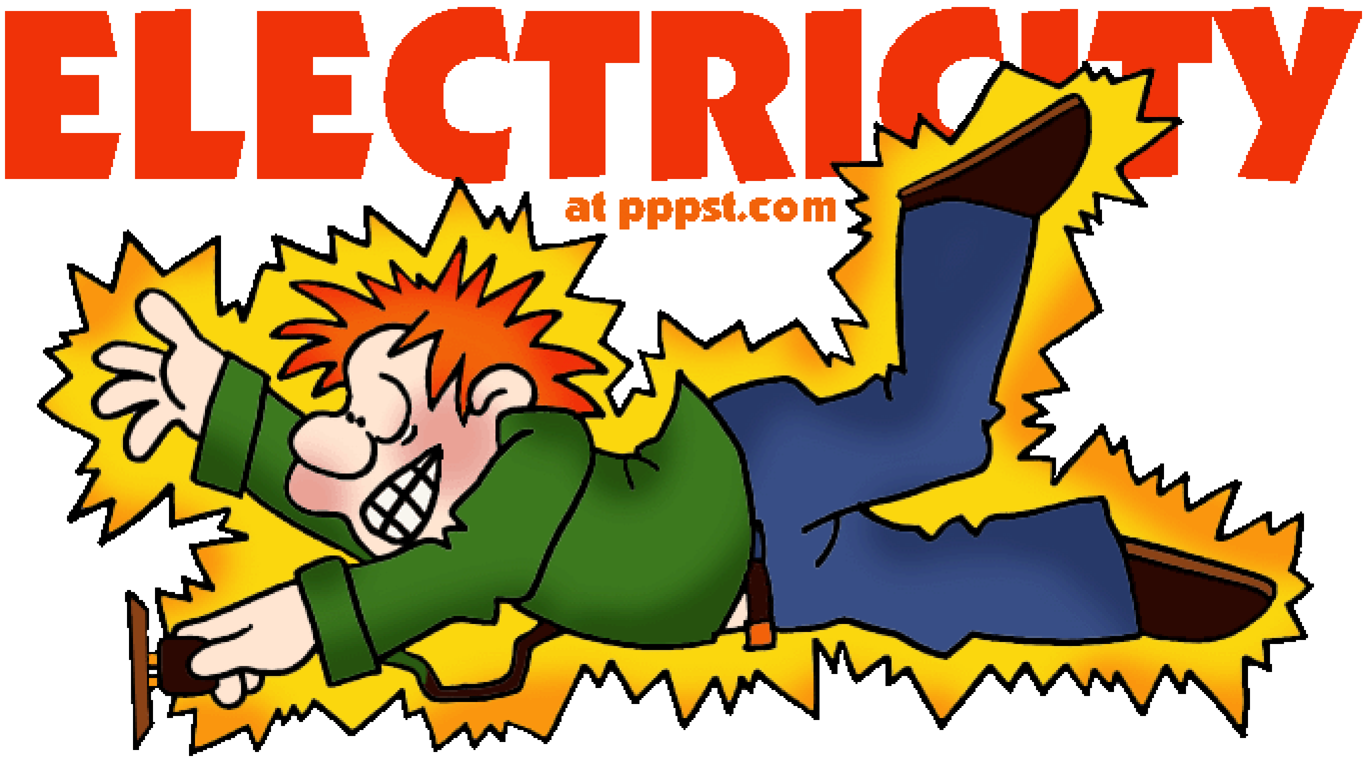

ELECTRICITY
at pppst.com

Electrostatics

Nay, electrophun!!!

Field flux: point charge in a sphere

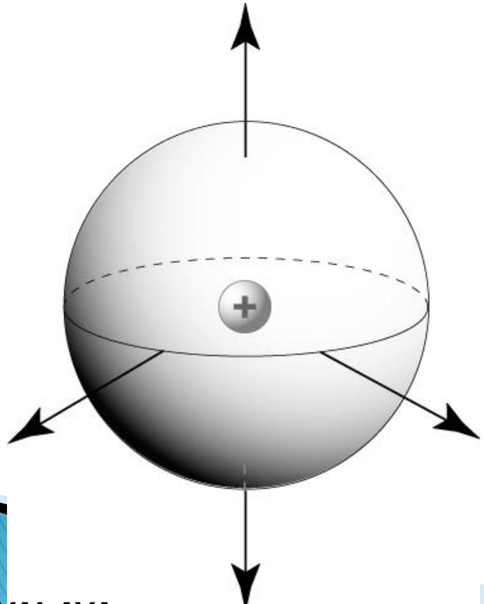
- Point charge has spherically-symmetric field
- Field is constant on sphere surface
- Flux is independent of sphere diameter

$$\Phi = \int_0^{\pi}\int_0^{2\pi} DE(r) r^2 \sin\theta d\theta d\psi$$

$$= DE(r) 4\pi r^2$$

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

$$= \frac{q}{\varepsilon_0}$$



Field from a charged plane

- Suppose we have
  - Homogeneous medium
  - Surface of area *A*, where *A* is "very big" (one dimensional)
  - Surface charge density of σ
- What is the field at distance *r* from the source?
- Compute the flux through a "pillbox"
- Calculate the enclosed charge
- Use Gauss' Law

$$\Phi = \oiint_{\partial(\text{pillbox})} D\mathbf{E}(\mathbf{s}) \cdot d\mathbf{s}$$

$$= 2\int_0^{2\pi}\int_0^R DE(z)\, r\,dr\,d\theta$$

$$+ \int_0^{2\pi}\int_0^z D \cdot 0 \cdot r\,dz\,d\theta$$

$$= 4\pi R^2 DE(z) = 2ADE(z)$$

$$\Phi = \int_{\text{pillbox}} \rho(\mathbf{x})\, d\mathbf{x} = \frac{q}{\varepsilon_0} = \frac{\sigma A}{\varepsilon_0}$$

$$2ADE(z) = \frac{\sigma A}{\varepsilon_0}$$

$$E(z) = \frac{\sigma}{2\varepsilon_0 D}$$