

Gauss's Law

Gauss's Law states that the No. of Electric field lines passing through a closed surface is $\frac{1}{\epsilon_0}$ times the charge enclosed by a closed surface.

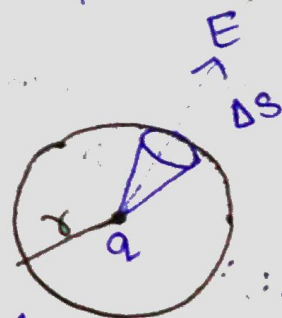
$$\boxed{\phi = \oint \vec{E} \cdot d\vec{s} = \frac{1}{\epsilon_0} q}$$

Consider the total flux through a sphere of radius r , which encloses a point charge q at its center.

Flux through an area element ΔS is

$$\Delta\phi = E \cdot \Delta S$$

$$\boxed{\Delta\phi = \frac{q}{4\pi\epsilon_0 r^2} \Delta S}$$



Here Electric field is Uniform

The total flux through the sphere is obtained by adding up flux through all the different area elements

$$\phi = \sum_{\text{all } \Delta S} \frac{q}{4\pi\epsilon_0 r^2} \Delta S$$

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$$\phi = \frac{q}{4\pi\epsilon_0 r^2} S$$

$$\boxed{S = 4\pi r^2}$$