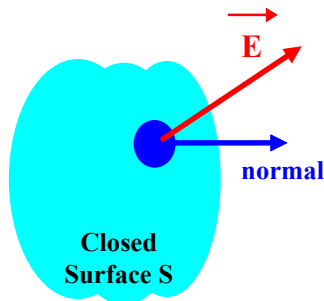


Electric Flux and Gauss' Law

The electric flux through any closed surface is proportional to the net charge enclosed.



Gauss' Law

$$\oint_S \vec{E} \cdot d\vec{A} = \frac{Q_{\text{enclosed}}}{\epsilon_0}$$

For the discrete case the total charge enclosed is the sum over all the enclosed charges:

$$Q_{\text{enclosed}} = \sum_{i=1}^N q_i$$

For the continuous case the total charge enclosed is the integral of the charge density over the volume enclosed by the surface S:

$$Q_{\text{enclosed}} = \int \rho dV$$

Simple Case: If the electric field is constant over the surface and if it always points in the same direction as the normal to the surface then

$$\Phi_E = \oint_S \vec{E} \cdot d\vec{A} = EA$$

The units for the electric flux are Nm^2/C .