Electric current is the net charge that flows through a surface per unit time

$$i = \frac{dq}{dt}$$
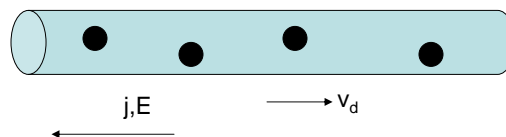
$$q = \int i\,dt$$

Current density $j = i/A$

$$i = \int \vec{j} \bullet d\vec{A}$$

$$\vec{j} = -en\vec{v}_d$$

$\vec{v}_d$ is the drift velocity

j,E $\longrightarrow$ v$_d$

Ohm's law: The resistivity (or conductivity) of a material is independent of the magnitude and direction of the applied electric field.

$$\vec{j} = \sigma\vec{E}$$

$$\vec{E} = \rho\vec{j}$$

$$R = \frac{\Delta V}{I} \qquad R = \rho\frac{L}{A}$$