Current

$I = \frac{dQ}{dt}$ | $n = N/V = e^{-}$density

Ohm's Law

$V = IR$ | define Resistivity : how much a material resists | $[\rho] = \Omega m$ | $R = \frac{\rho L}{A}$

Power

$P = IV = I^2R = \frac{V^2}{R}$

Circuits

Electrostatics

Net charge of system is conserved

Coulomb's Law

Charged objects repel and attract $\therefore \exists$ force between charged obj. $\vec{F} = \frac{|q_1 q_2|}{4\pi\varepsilon_0 r^2}$
$\varepsilon_0 = 8.85 \times 10^{-}12 \frac{C^2}{Nm^2}$

Electric Fields

Points radially away from + and towards - $\vec{E} \equiv \frac{\vec{F}}{Q}$ | $[\vec{E}] = \frac{N}{C} = \frac{V}{m}$ $\vec{E} = \frac{q}{4\pi\varepsilon_0 r^2}\hat{r}$
$\vec{E} = \sum \vec{E_i} = \frac{q}{4\pi\varepsilon_0 r_i^2}\hat{r}_i$

Continuous Charge Distributions

$\vec{E} = \int d\vec{E} = \int \frac{dq}{4\pi\varepsilon_0 r^2}\hat{r}$