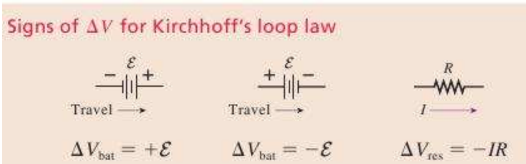
Electron current i_e and $N_e = i_e \cdot \Delta t$
The drift speed $v_d = \frac{e\tau}{m}E$, where τ is the mean time between collisions.
The electron current is related to the drift speed by $i_e = n_e A v_d$, where n_e is the electron density.
Conventional current $I = e i_e$ and $Q = I\Delta t$
Current density $J = \frac{I}{A}$
An electric field E in a conductor causes a current density $J = n_e e v_d = \sigma E$, where the **conductivity** is $\sigma = \frac{n_e e^2 \tau}{m}$
The resistivity is $\rho = \frac{1}{\sigma}$
A potential difference ΔV_{wire} between the ends of a wire creates an electric field inside the wire: $E_{wire} = \frac{\Delta V_{wire}}{L}$
The size of the current in the wire is $I = \frac{\Delta V_{wire}}{R}$, where $R = \frac{\rho L}{A}$ is the wires resistance. This is **Ohms law**.
Kirchhoffs junction law: $\sum I_{in} = \sum I_{out}$
Kirchhoffs loop law: $\sum(\Delta V)_i = 0$



A potential difference ΔV between the ends of a conductor with resistance R creates a current $I = \frac{\Delta V}{R}$.
The battery supplies energy at the rate $P_{bat} = IV_{bat}$
The resistors dissipate energy at the rate $P_R = I\Delta V_R = I^2 R = \frac{(\Delta V_R)^2}{R}$
Series resistors $R_{eq} = R_1 + R_2 + R_3 + \cdots$
Parallel resistors $R_{eq} = \left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots\right)^{-1}$
The discharge of a capacitor through a resistor satisfies: $Q = Q_0 e^{-\frac{t}{\tau}}$ and $I = -\frac{dQ}{dt} = \frac{Q_0}{\tau}e^{-\frac{t}{\tau}} = I_0 e^{-\frac{t}{\tau}}$, where $\tau = RC$ is the time constant.

Material	**Resistivity** $(\Omega \cdot m)$	**Conductivity** $((\Omega \cdot m)^{-1})$
Aluminum	2.8×10^{-8}	3.5×10^{7}
Copper	1.7×10^{-8}	6.0×10^{7}
Gold	2.4×10^{-8}	4.1×10^{7}
Iron	9.7×10^{-8}	1.0×10^{7}
Silver	1.6×10^{-8}	6.2×10^{7}
Tungsten	5.6×10^{-8}	1.8×10^{7}
Nichrome	1.5×10^{-6}	6.7×10^{5}
Carbon	3.5×10^{-5}	2.9×10^{4}