RESISTANCE

When current flows through a wire, heat energy is generated.

Heat energy/second = Heat power = I²R,
where R is the resistance, Watts/Amp² = Ohm

A length of wire.  Current I = \( \frac{Q}{t} \)

\[
R = \rho \frac{L}{A}, \quad \rho \text{ is resistivity, (Ohm meter)} \quad 10^{-8} \text{ to } 10^{+16}
\]

In general \( \rho \) depends on Temperature.

\[
\rho = \rho_0(1 + \alpha(T - T_0))
\]

Velocity of electrons in wires is very slow.

Current  \( I = n e v A \)

\[
v = \frac{I}{neA} = \frac{1 \text{ amp}}{10^{28} \times 1.6 \times 10^{-19} \times 10^{-6}} = 6 \times 10^{-4} \text{ m/s}
\]