Electrical Analogy for Thermal Conduction.

It is an important fact to appreciate that there exists an exact similarity between thermal and electrical conductivities of a conductor.

Electrical conduction	Thermal conduction
Electric charge flows from higher potential to lower potential	Heat flows from higher temperature to lower temperature
The rate of flow of charge is called the electric current, i.e. $I = \frac{dq}{dt}$	The rate of flow of heat may be called as heat current i.e. $H = \frac{dQ}{dt}$
The relation between the electric current and the potential difference is given by Ohm's law, that is $I = \frac{V_1 - V_2}{R}$ where R is the electrical resistance of the conductor	Similarly, the heat current may be related with the temperature difference as $H = \frac{\theta_1 - \theta_2}{R}$ where R is the thermal resistance of the conductor
The electrical resistance is defined as $R = \frac{\rho l}{A} = \frac{l}{\sigma A}$ where ρ = Resistivity and σ = Electrical conductivity $\frac{dq}{dt} = I = \frac{V_1 - V_2}{R} = \frac{\sigma A}{l}(V_1 - V_2)$	The thermal resistance may be defined as $R = \frac{l}{KA}$ where K = Thermal conductivity of conductor $\frac{dQ}{dt} = H = \frac{\theta_1 - \theta_2}{R} = \frac{KA}{l}(\theta_1 - \theta_2)$