The R-value of insulation put in the walls and ceiling of a house is usually given in units per square area, e.g., $m^2 \cdot {}^\circ C/W$. The amount of heat flow across a wall is:

$$Flow = Area * (T1-T2)/R\text{-}value$$

Another important parameter occurring when current flows through a resistor is **power**. The power (*P* in watts) dissipated in a resistor can be calculated from voltage (*V* in volts), current (*I* in amps), and resistance (*R* in ohms). Interestingly, although voltage has a polarity (+ and –) and current has a direction, power has neither a polarity nor a direction.

$P = V * I$ $\quad$ *Power = Voltage * Current*

$P = V^2 / R$ $\quad$ *Power = Voltage^2 / Resistance*

$P = I^2 * R$ $\quad$ *Power = Current^2 * Resistance*

CHECKPOINT 3.6

There is 1 V across a resistor, and 5 mA is flowing. How much power is being dissipated?

Hide Answer

Power is V*I = 1V*0.005A = 5 mW.

CHECKPOINT 3.7

There is 2 V across a 100Ω resistor. How much power is being dissipated?

Hide Answer

Power is V^2/R = 2V*2V/100Ω = 40 mW.

The **energy** (*E* in joules) stored in a battery can be calculated from voltage (*V* in volts), current (*I* in amps), and time (*t* in seconds). In a manner similar to power, energy has neither a polarity nor a direction.

$E = V * I * t$ $\quad$ *Energy = Voltage * Current * time*

$E = P * t$ $\quad$ *Energy = Power * time*