

Source: [KBhPHYS201IntroToElectrostaticsLN](#) | [KBhPHYS201CircuitsIndex](#)

1 | Resistance

So, let's figure out resistance.

We know that... $V = \frac{J}{C}$, per [KBhPHYS201Voltage](#), and we also know that resistance would equal a unit $\frac{Vs}{C}$ given that $I = \frac{C}{s} = \frac{\Delta V}{Resistance}$ (see [KBhPHYS201Current](#) Current). Plugging in the definition of voltage, we get that resistance is measured in $\frac{Js}{C^2}$. We call this unit Ohms, or Ω .

Definition 1 · **Resistance** Ω A value measured in $\frac{Js}{C^2}$ that measures the resistance to current

1.0.1 | Calculating resistance

- So, let's think. With a wire of length L and with a wire of area A , if we increase L , the resistance in the wire would increase; if we increase area A , the resistance in the the wire would decrease.
- $Resistance = \frac{L}{A} * ResistivityOfMaterial$ with units $\frac{m}{m^2} (\Omega \times m)$.

and, indeed, resistivity of materials are measured in $\Omega \times m$, which also makes sense intuitively.

1.0.2 | Heat of resistance

$$I = \frac{Q}{s} \quad V = \frac{J}{C}$$

$$P = \frac{J}{s} \quad IV = \frac{J}{s} = W_{\text{heat}}$$

Figure 1: [KBe20phys250srcHeatFromResistors](#).png

2 | Ohm

$$\Omega = \frac{V}{A} = \frac{1}{S} = \frac{W}{A^2} = \frac{V^2}{W} = \frac{s}{F} = \frac{H}{s} = \frac{J \cdot s}{C^2} = \frac{kg \cdot m^2}{s \cdot C^2} = \frac{J}{s \cdot A^2} = \frac{kg \cdot m^2}{s^3 \cdot A^2}$$

(Wikipedia)