

## 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  $\Omega$ .

Resistance  $\Omega$ {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 wire would decrease.
- $Resistance = \frac{L}{A} * ResistivityOfMaterial$  with units  $\frac{m}{m^2} (\Omega \times m)$ .

Sometimes its easier to think about conductivity.

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

### 1.0.2 | Heat of resistance

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

$$P = \frac{J}{s} \quad IV = \frac{J}{s} = W$$

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)