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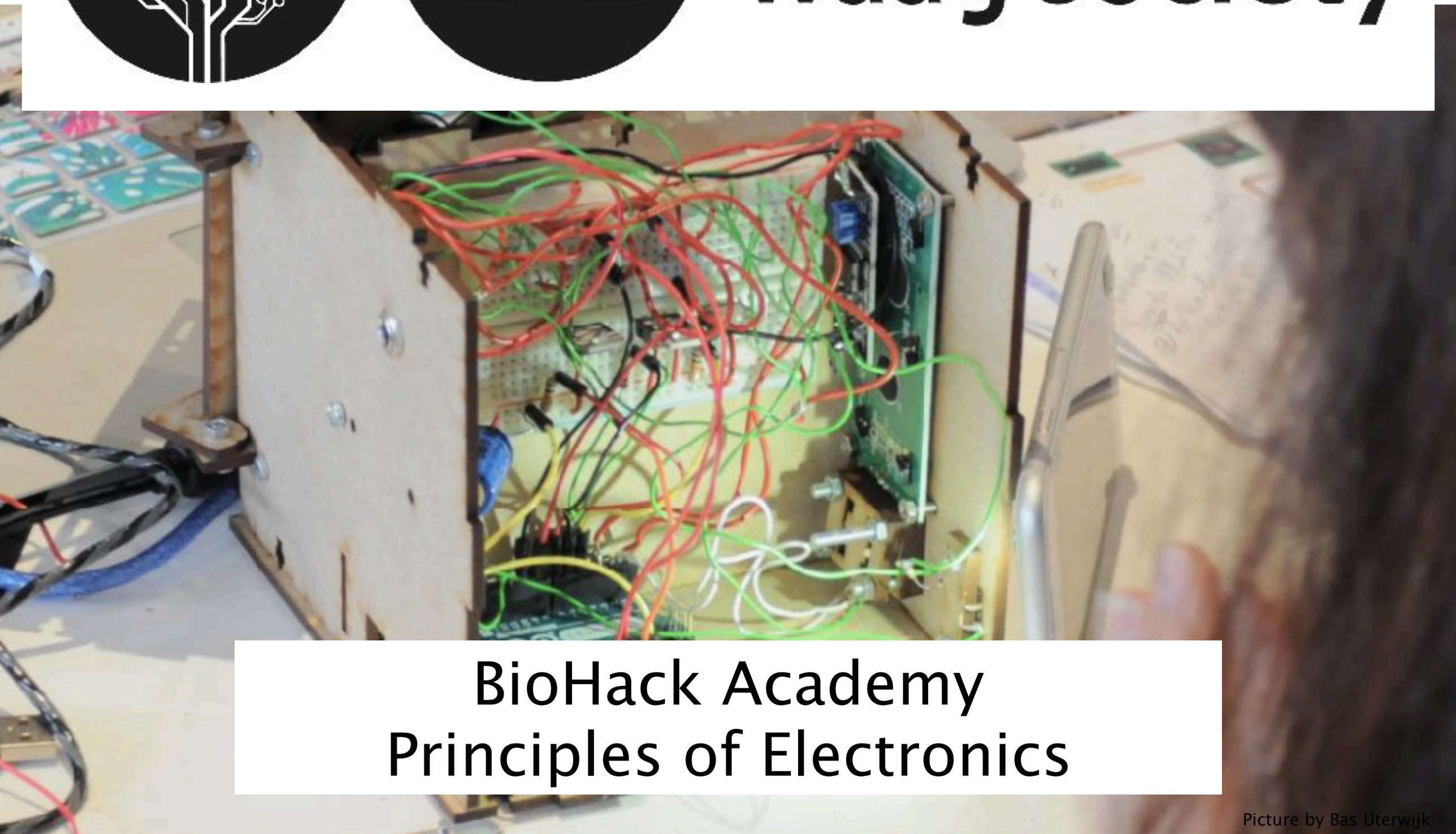


BioHack Academy
Principles of Electronics

Picture by Bas Uterwijk

A circuit

A circuit is a **CLOSED LOOP** in which electrons can flow.

Electrons flow = Current

How can I generate a Current?

By connecting two electrodes of a battery

For example: Battery + Resistor

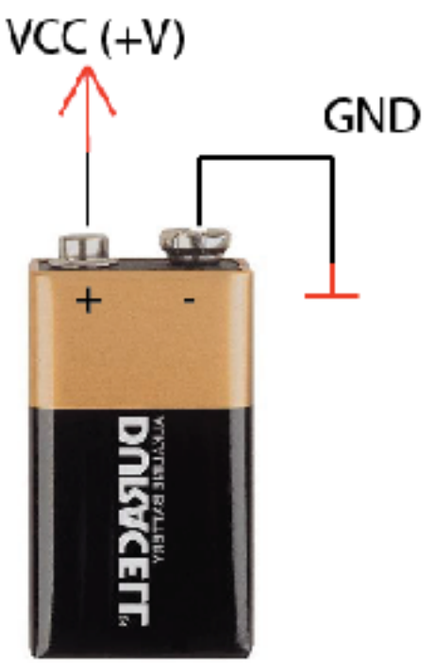
Battery

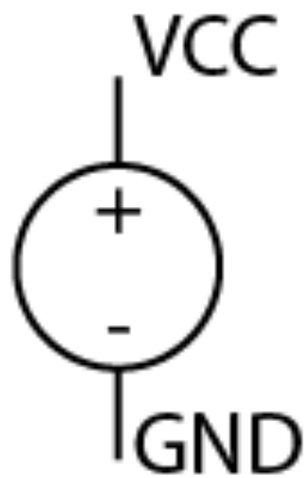
The battery is the power supply of our circuit.

It has two sides:
- + a.k.a. Plus, VCC, V+ or +V
- – a.k.a. Minus or GND

Unit of measure is Volt (V).

Voltage:
It's the difference in potential between two points





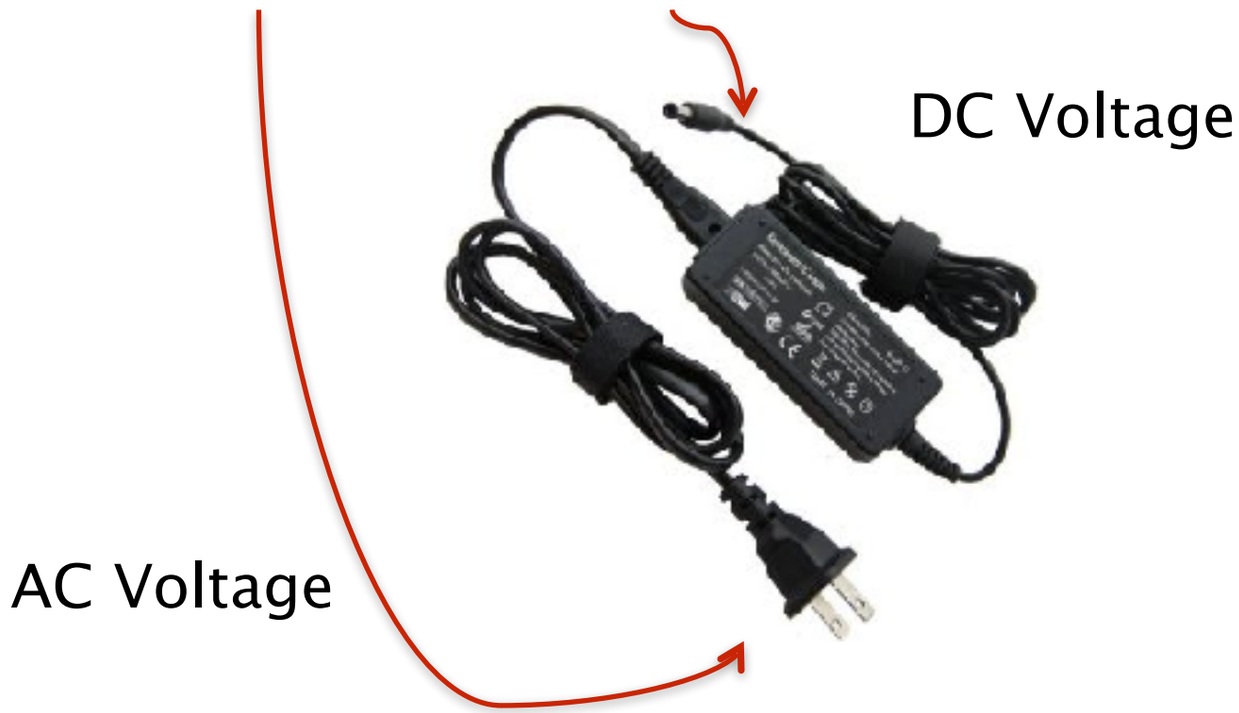
Batteries & Power Supplies

VCC = 9V

1.5V

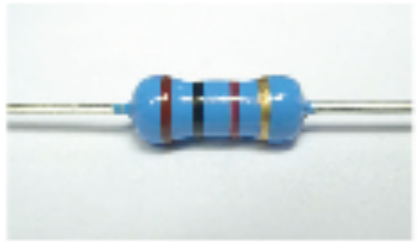
3V

From the grid (220V) to 12V (the output that be different), VCC = 12V.



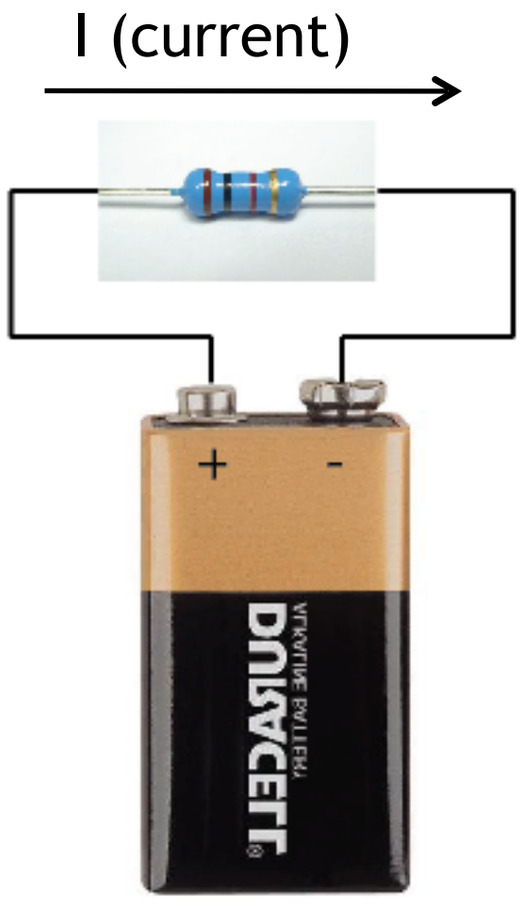
Resistor

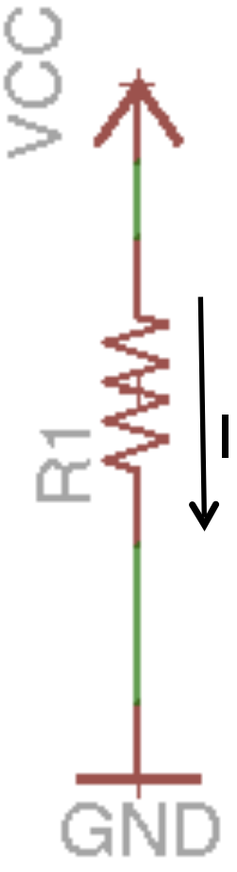
It has two sides
The orientation is irrelevant

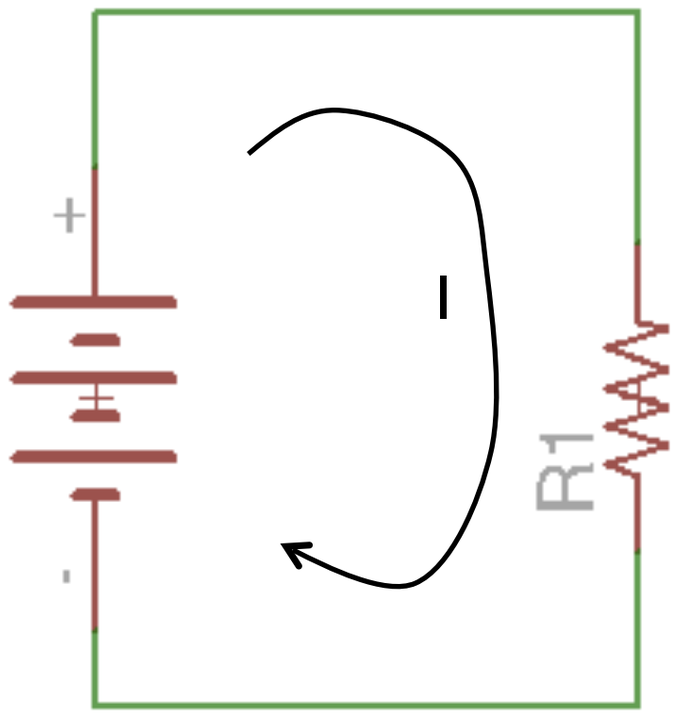


Unit of measure is Ohm (Ω)

A basic circuit

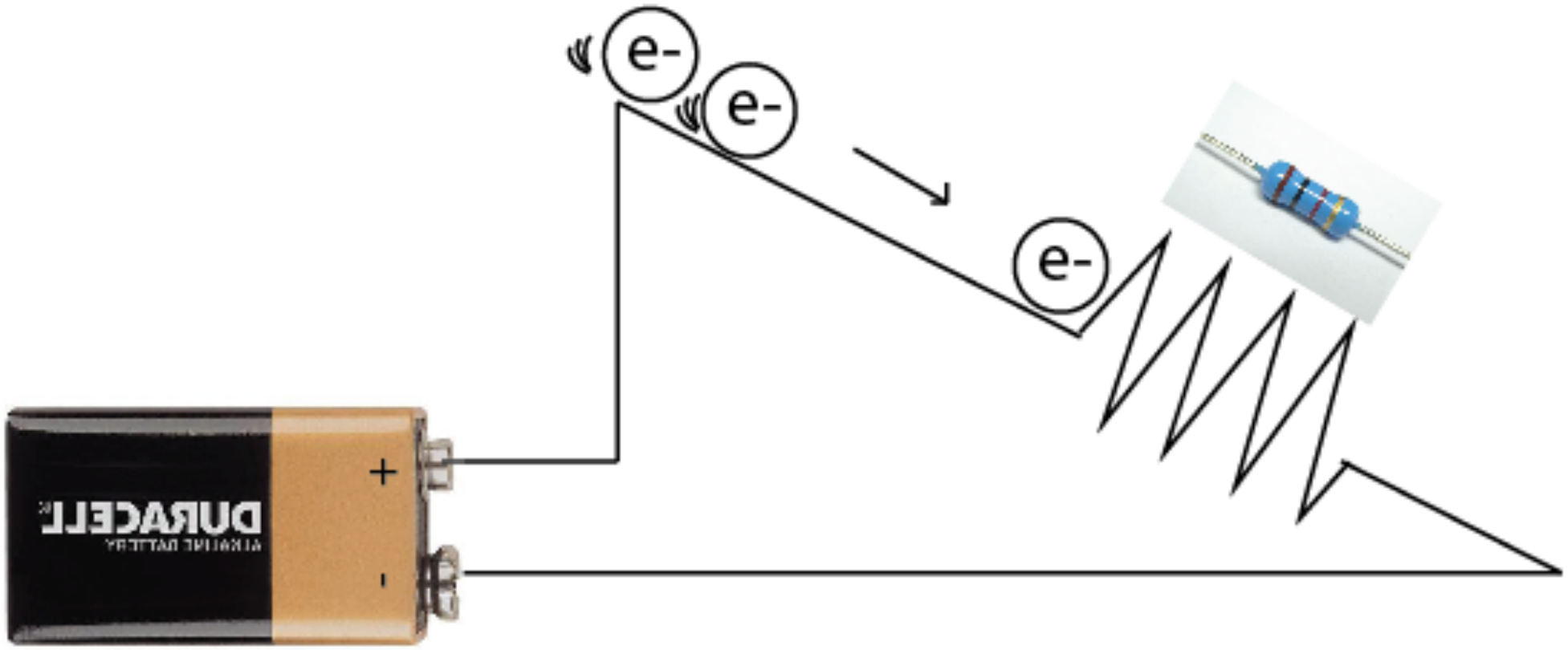




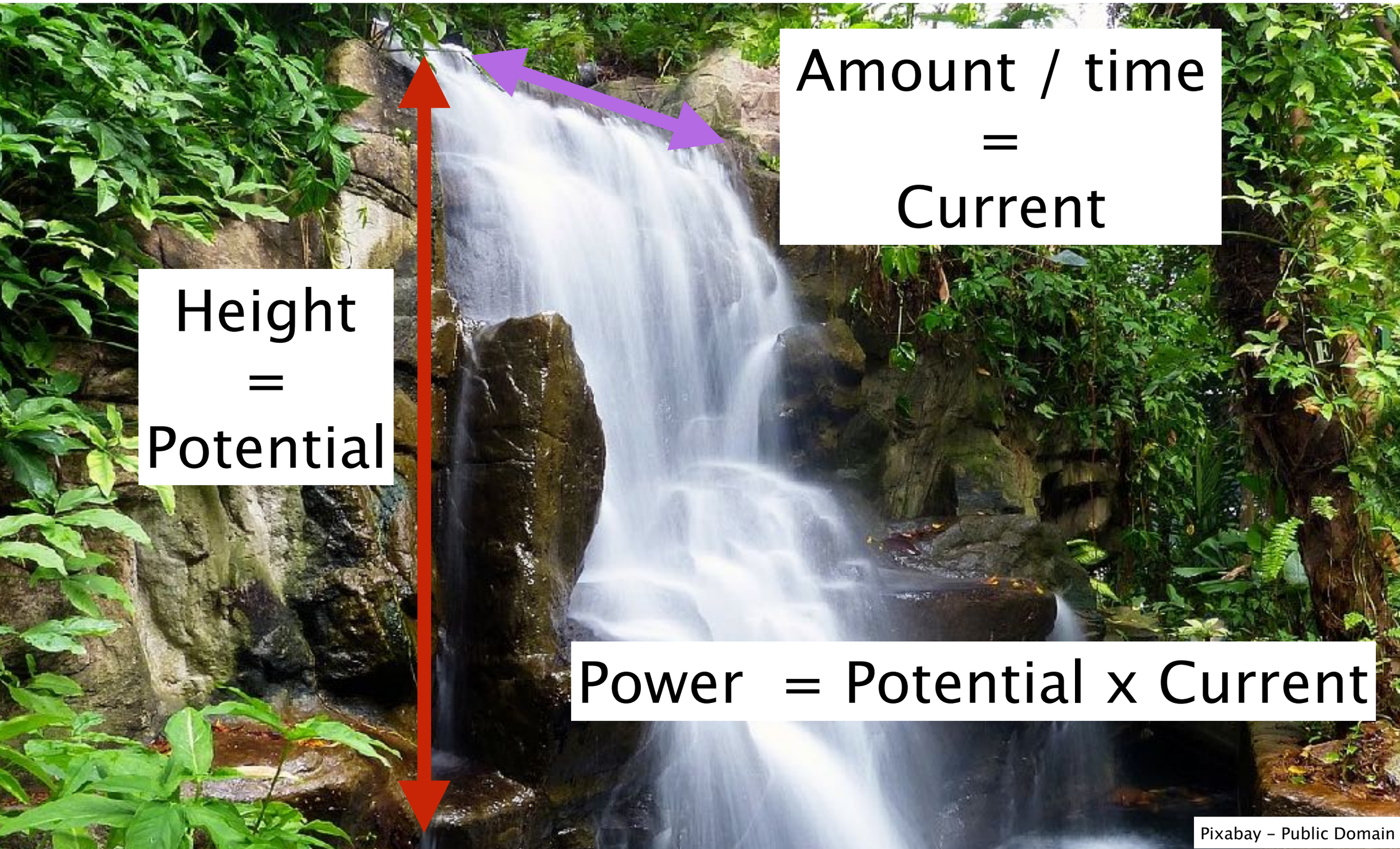


- **Voltage:** is the difference in potential between two points
- **Current:** is the rate at which charge is flowing
- **Resistance:** is a material's tendency to resist the flow of electrons / current

A basic circuit



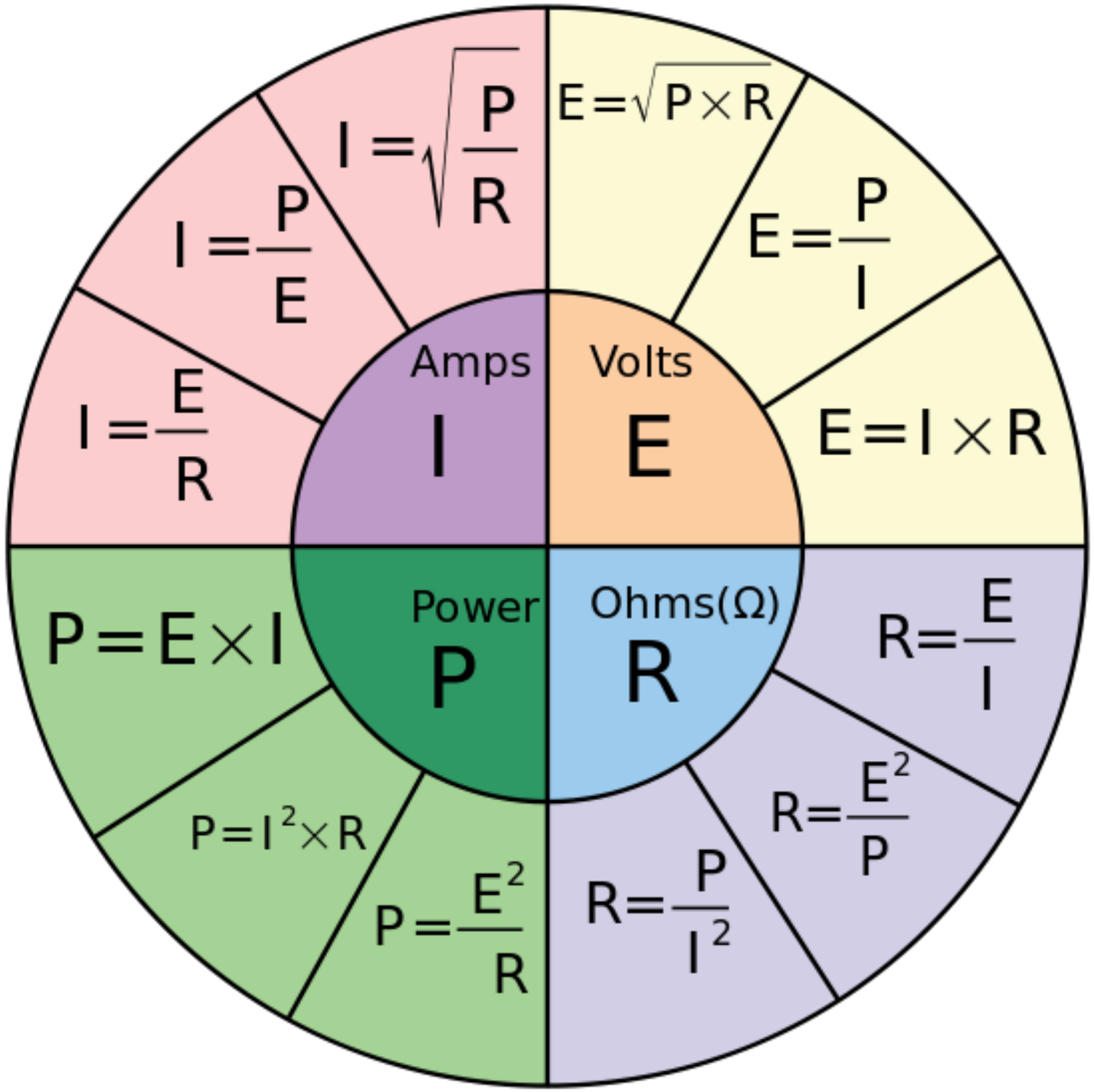
Electricity vs Waterfall



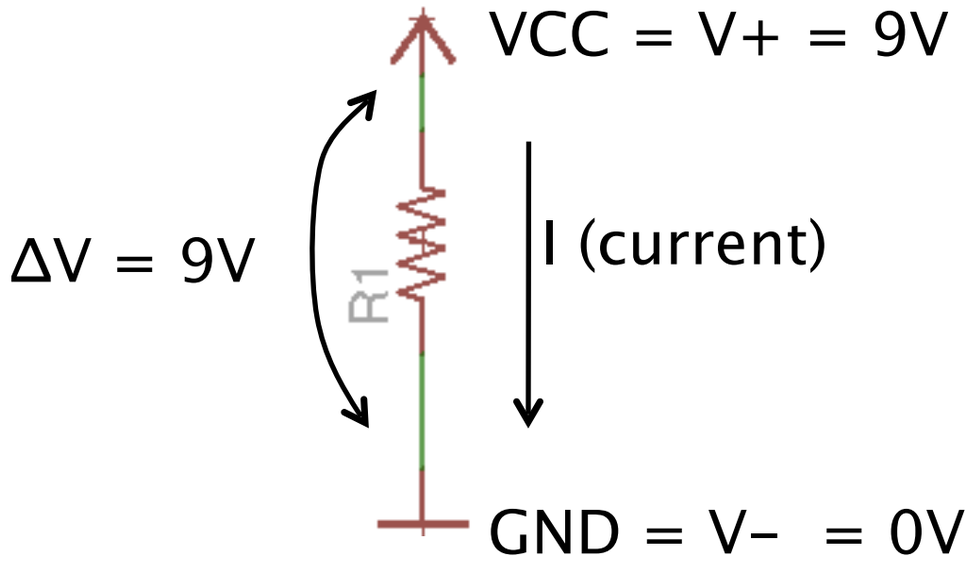
Ohm’s Law

$$U = R * I$$

Ohm’s Law



Using Ohm's Law



Ohm's Law

ΔV = (V+) - (V-) = R*I

V = R*I

I = V/R

R = V/I

Ex 1: Calculate the Current
V = 9V
R1 = 1kΩ = 1000Ω

I = V/R = (VCC – GND) / I = (9V – 0V)/1kΩ = 9mA = 0.009 A

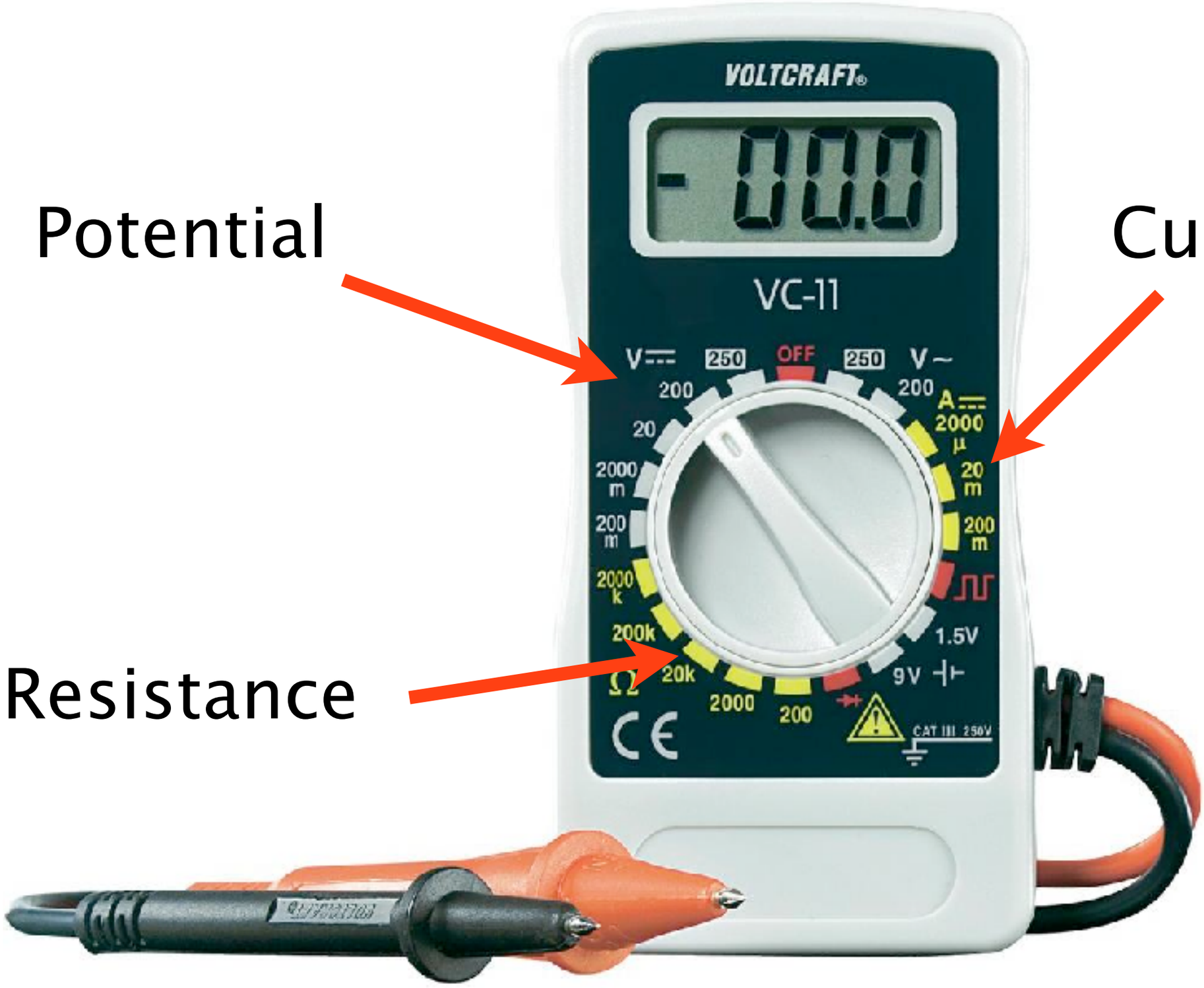
Ex 2: Calculate Resistance
V = 3V
I = 20mA

R = V/I = 3V/20mA = 3V/0.020A = 150Ω

Measuring

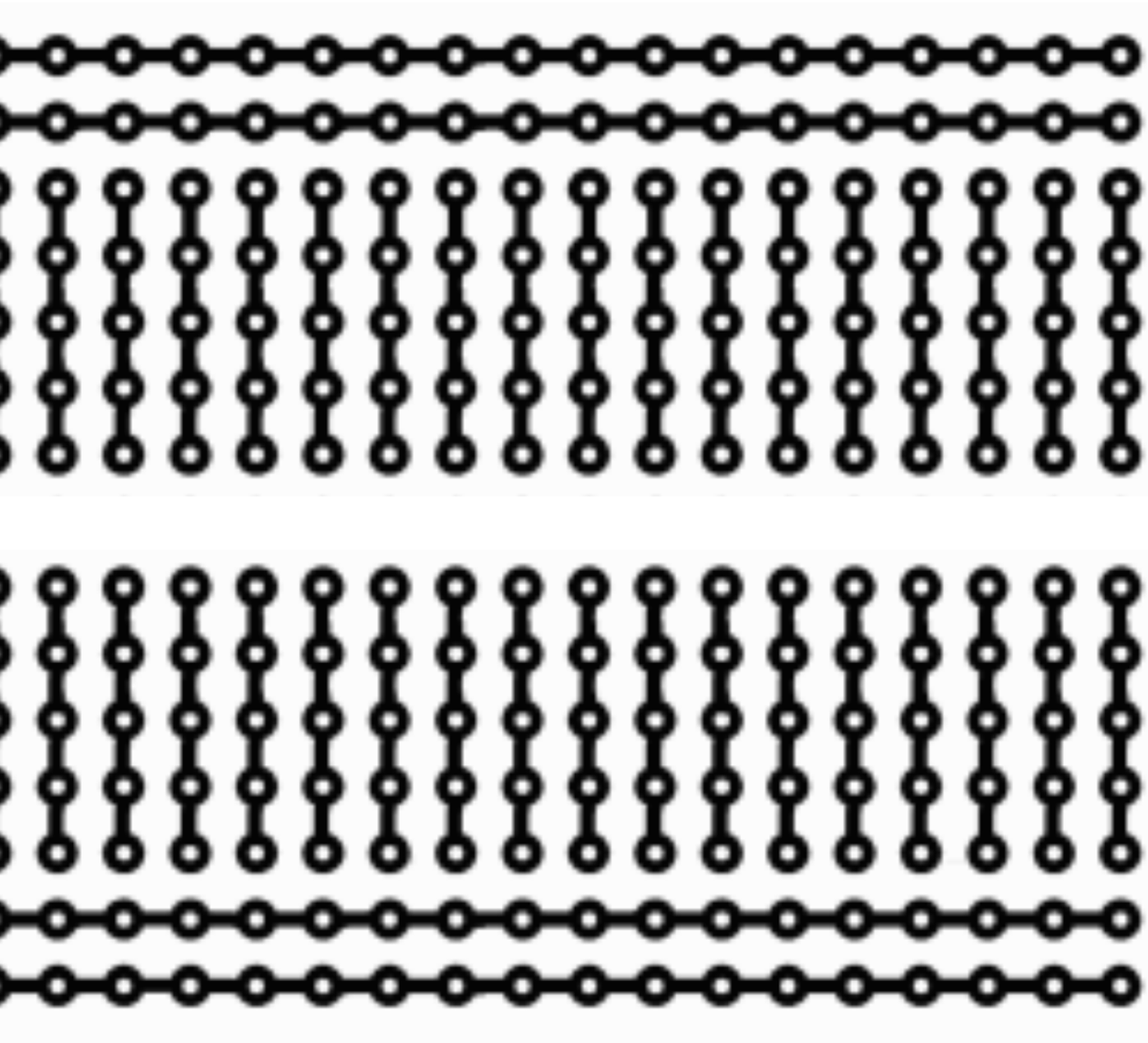
Potential

Current

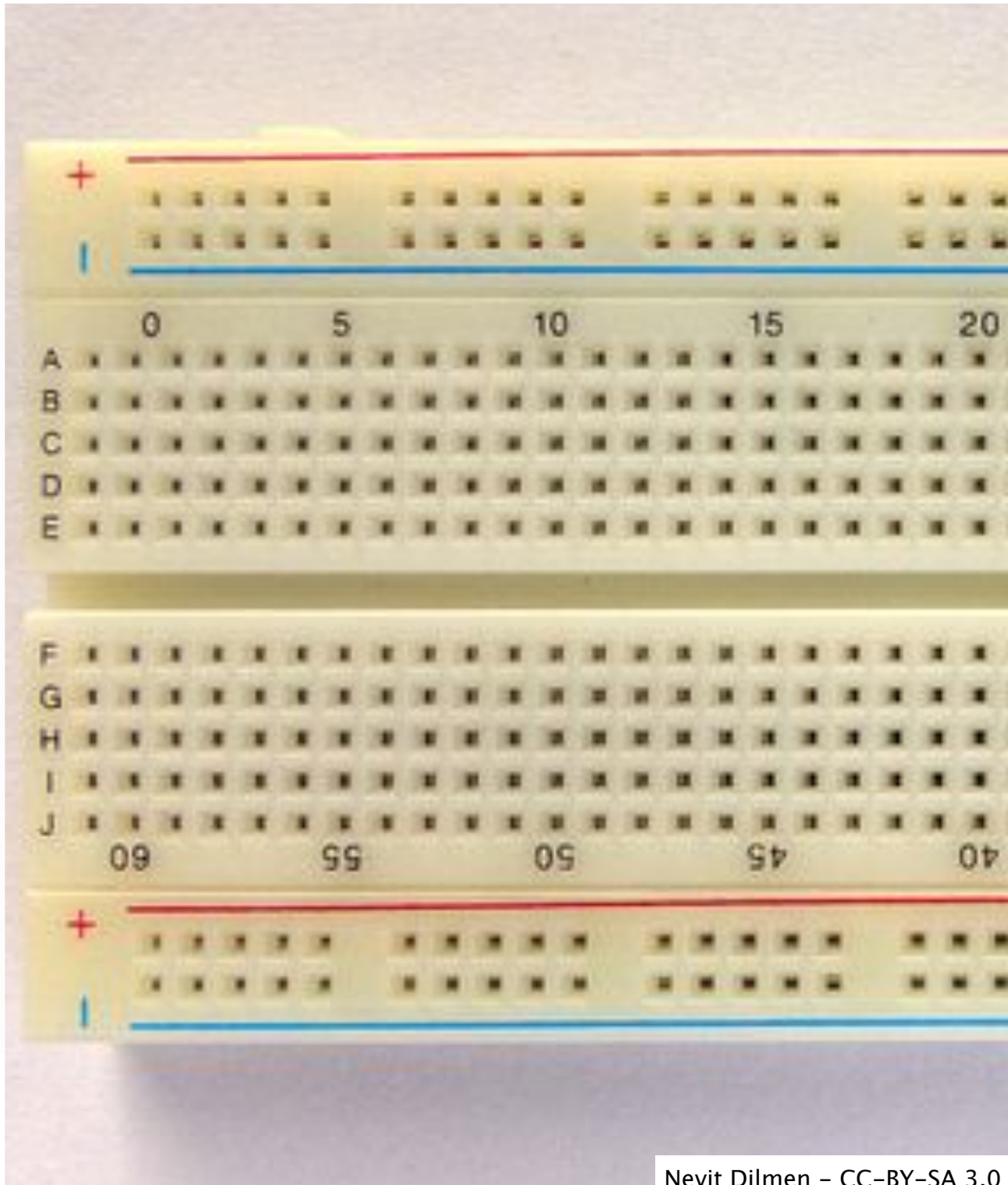


Resistance

Breadboard

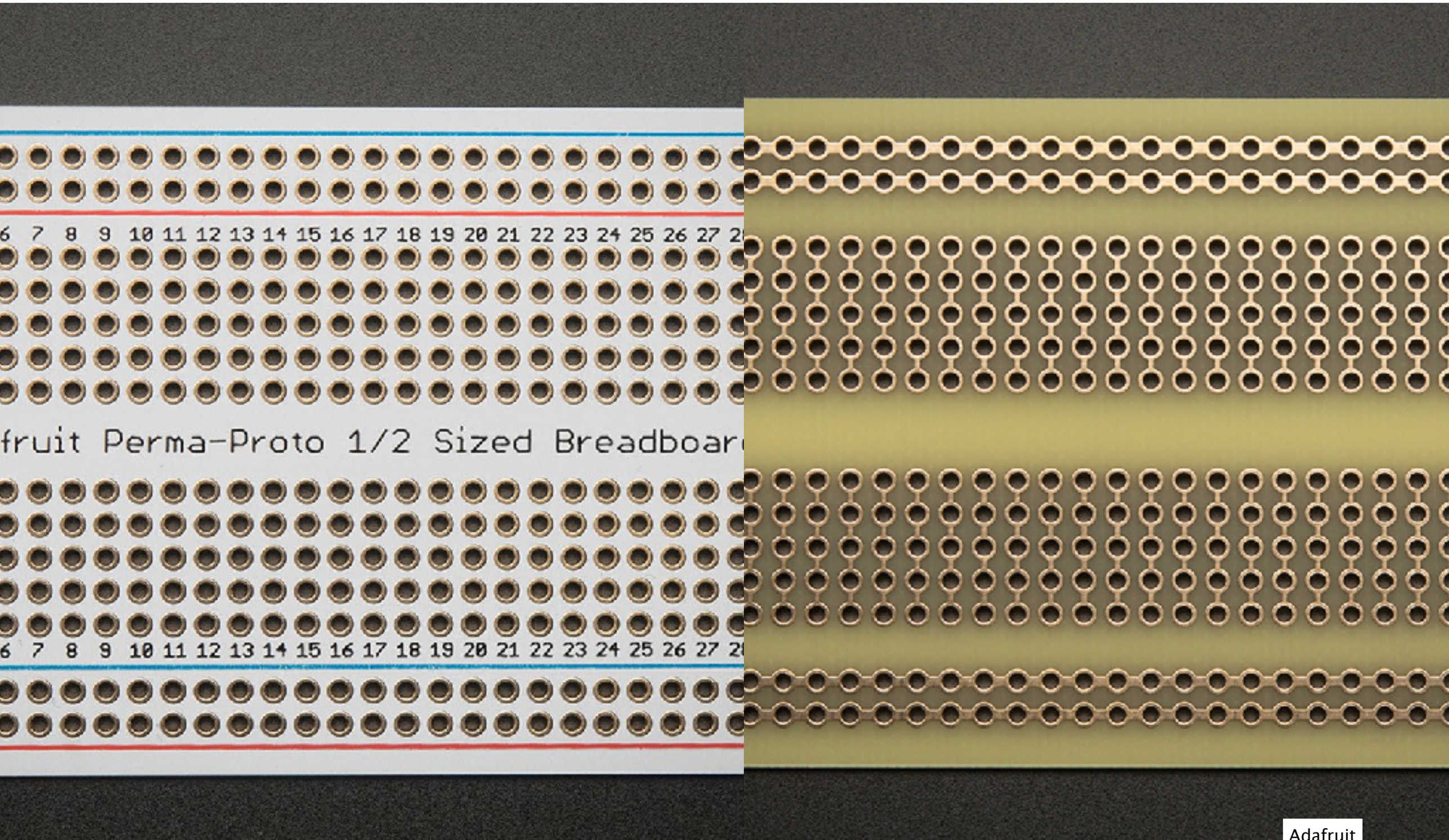


Hoenny - CC-BY-SA 3.0



Nevit Dilmen - CC-BY-SA 3.0

From breadboard to prototype board



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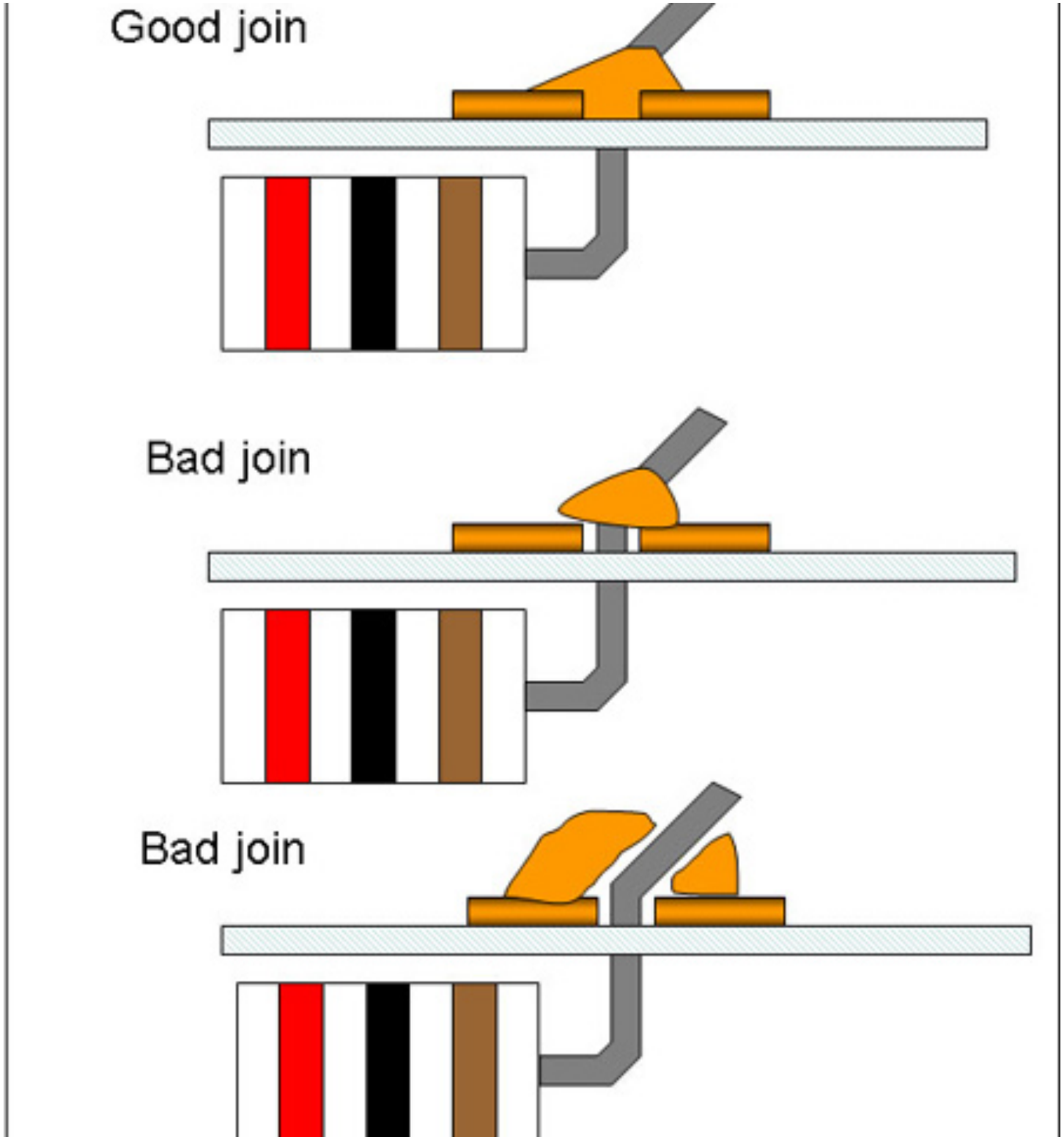
Soldering

Soldering Iron - 350 C

Soldering is easy



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Electrical Safety

Remember what your parents told you

Dangers:

- High voltage

- Low resistance

=

- High Current

- Make use of isolation!

- Better safe than sorry!