Physical Computing

Designing Physical Interactions for a Digital World

DESN 265
Spring 20121
Thursday 2PM – 5:30PM
Online and QC Makerspace

Professor Danne Woo
pcomp.dannewoo.com
danne.woo@qc.cuny.edu

Week 1-9

Week 1: What is Physical Computing?

Week 2: Introduction to Electronics

Week 3: Arduino, Hello World

Week 4: Analog Output

Week 5: Digital and Analog Review

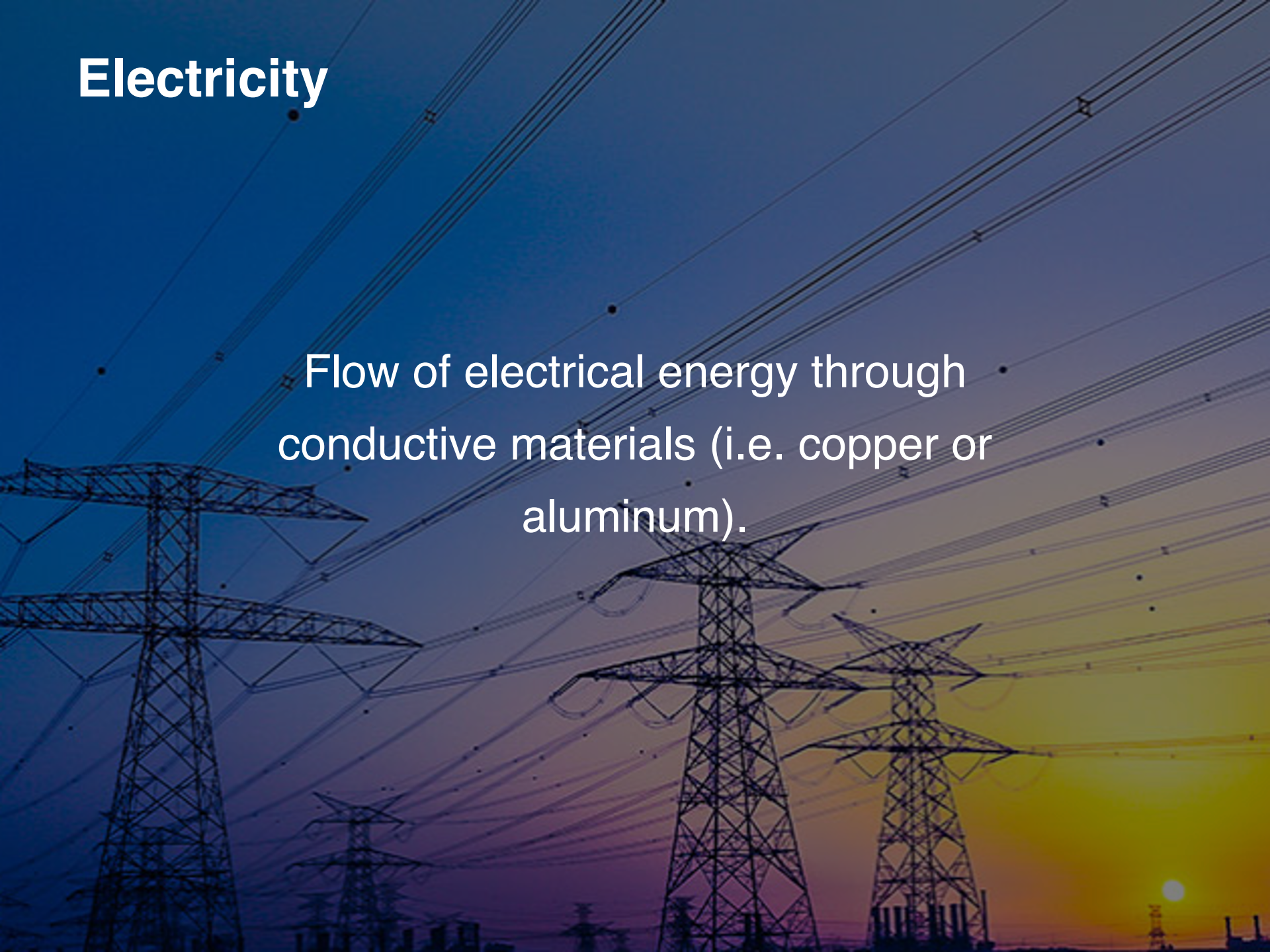
Week 6: Enclosures

Week 7: Serial Communication, Processing and p5.js

Week 8: Soldiering Workshop

Week 9: Midterm Presentation

Electricity

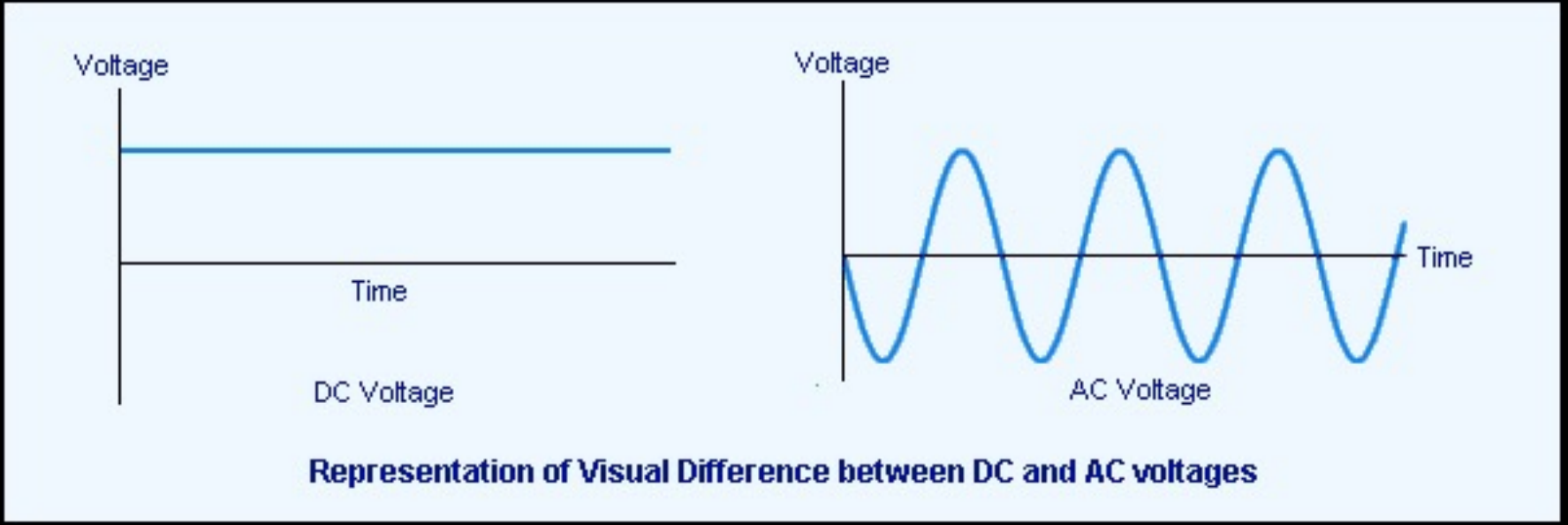


Flow of electrical energy through conductive materials (i.e. copper or aluminum).

AC/DC

DC (Direct Current): Flows in one direction.

AC (Alternating Current): Direction of current flow is reversed in a regular repeating cycle

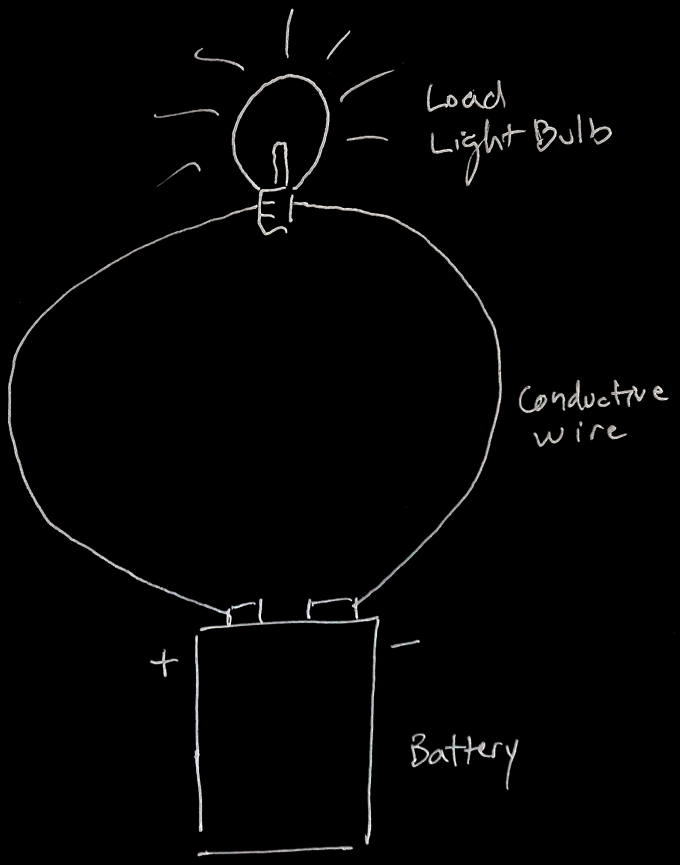


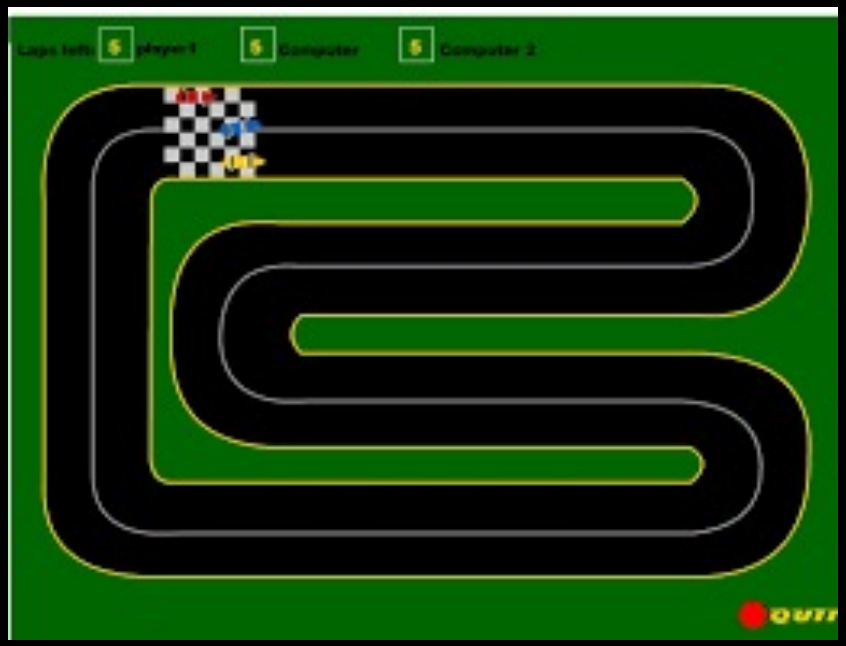
Representation of Visual Difference between DC and AC voltages

Electrical Circuit

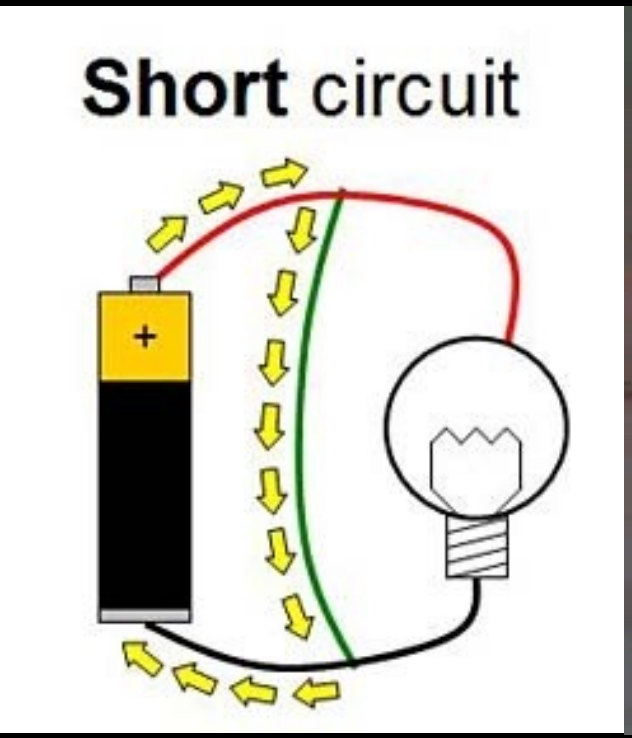
Made up by at least two elements: a power source (i.e. battery or outlet) and components that convert the electrical energy to other forms of energy (i.e. light, heat or kinetic) connected a highly conductive material.

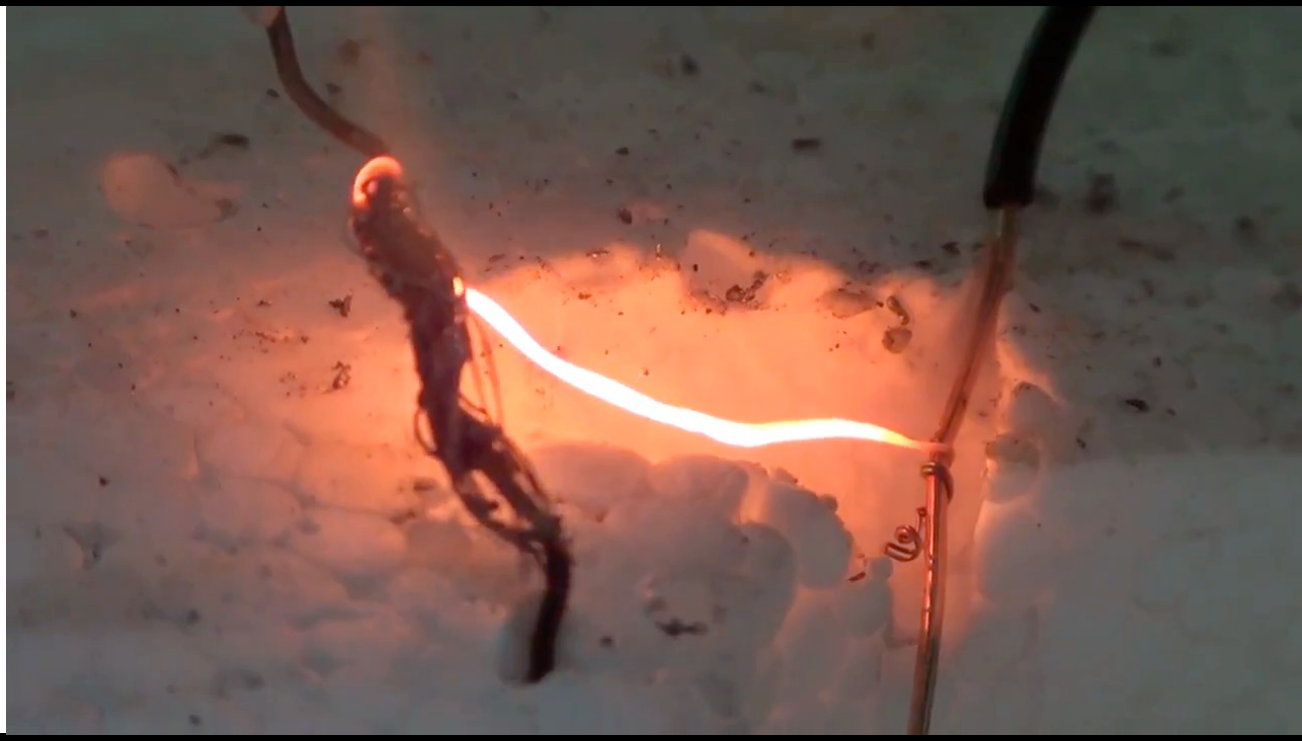
Electrical Circuit



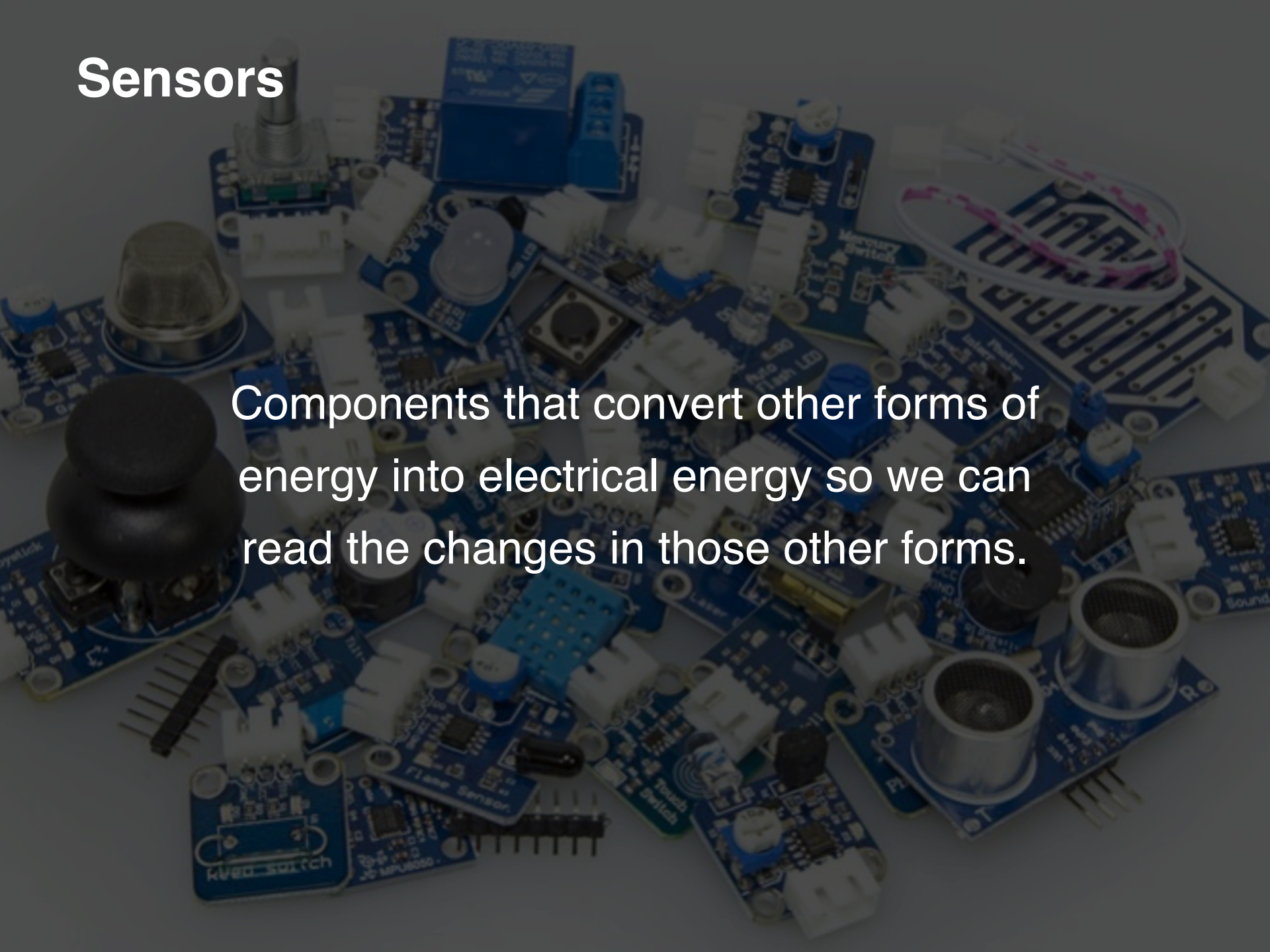


Short Circuit





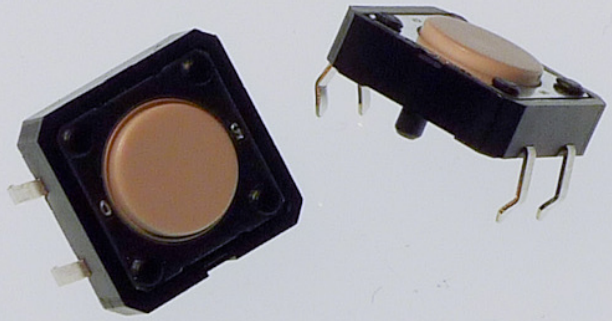
Sensors

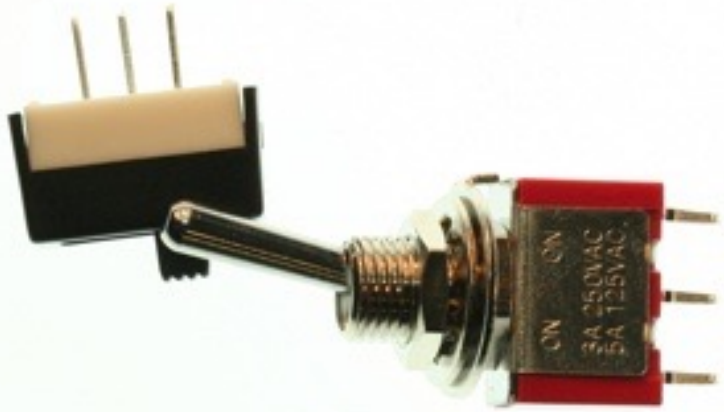


Components that convert other forms of energy into electrical energy so we can read the changes in those other forms.

Sensors

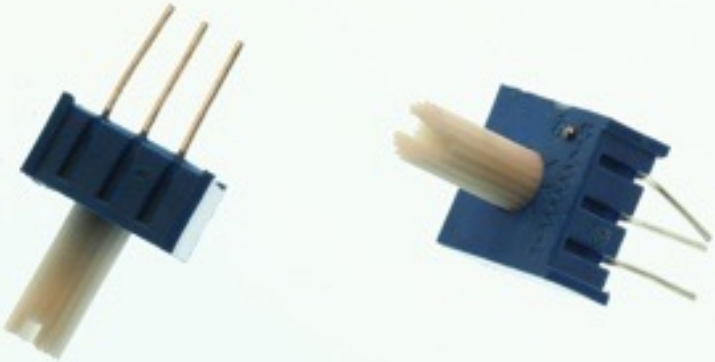
Momentary Switches (Buttons)



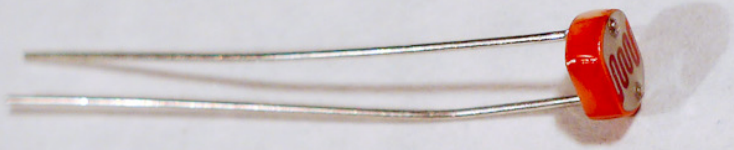


Toggle Switches

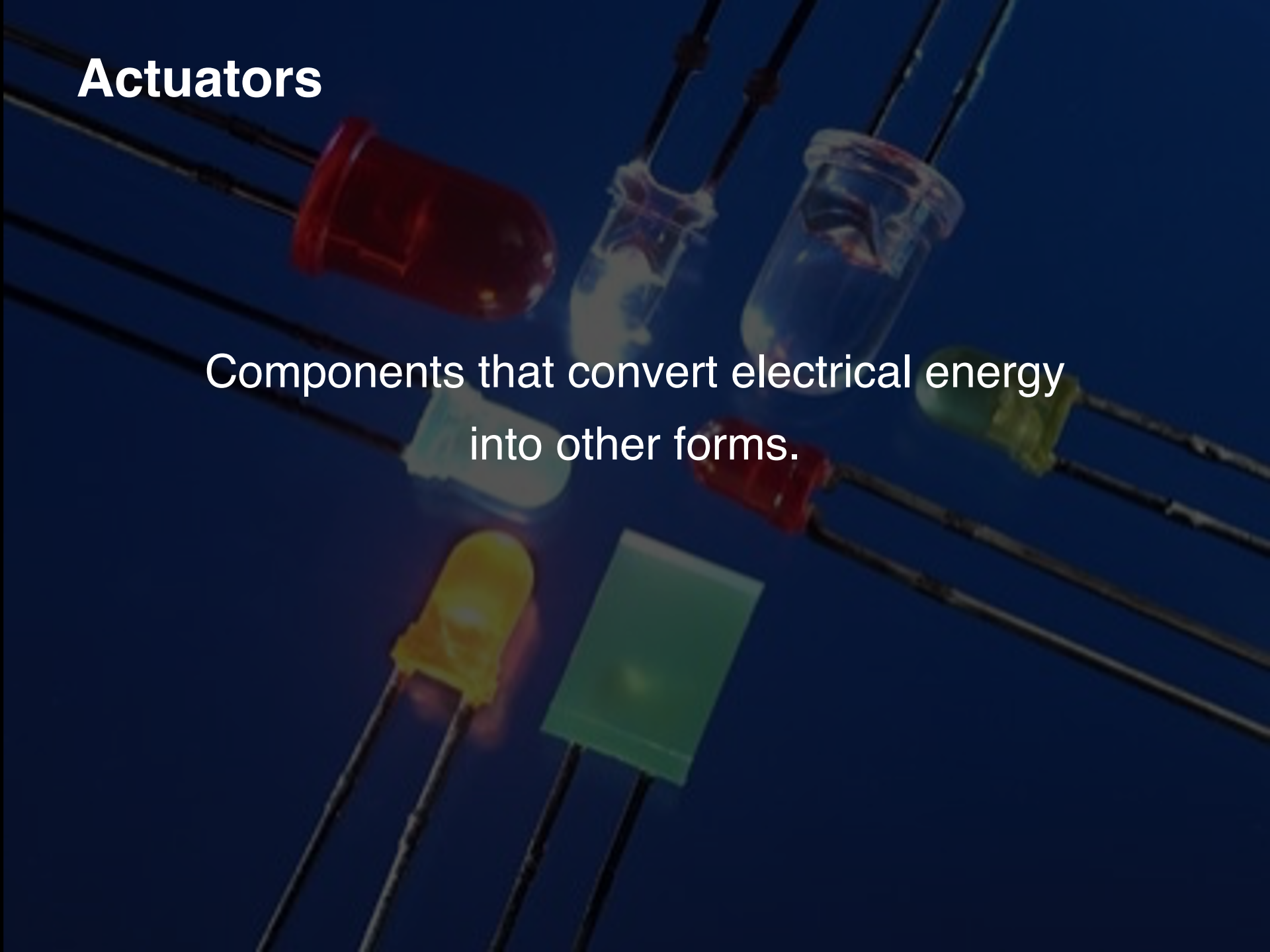
Potentiometers (Knobs)



Light Sensor



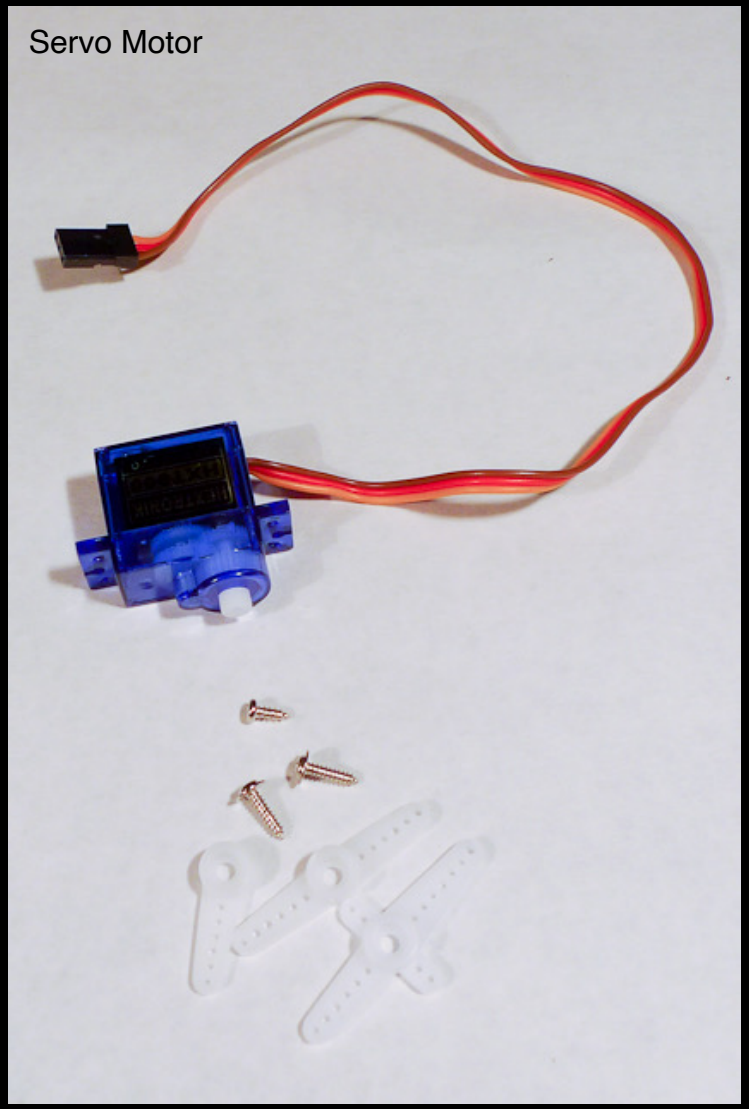
Actuators



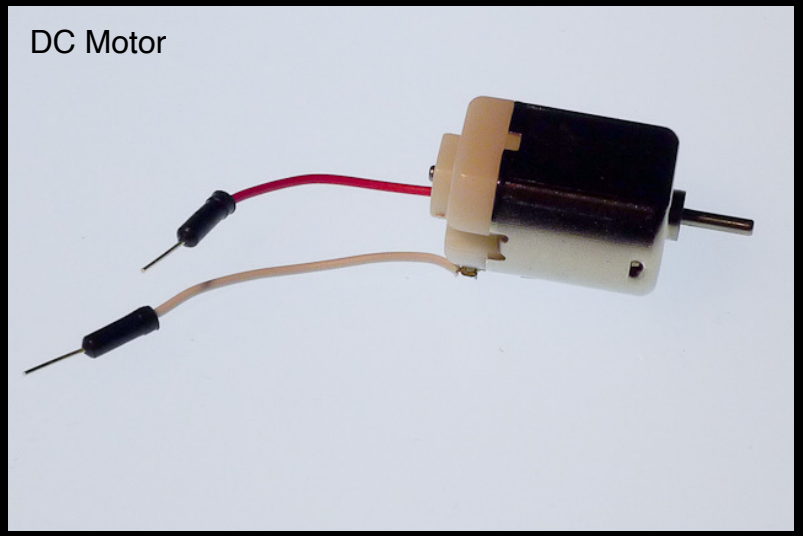
Components that convert electrical energy into other forms.

Actuators

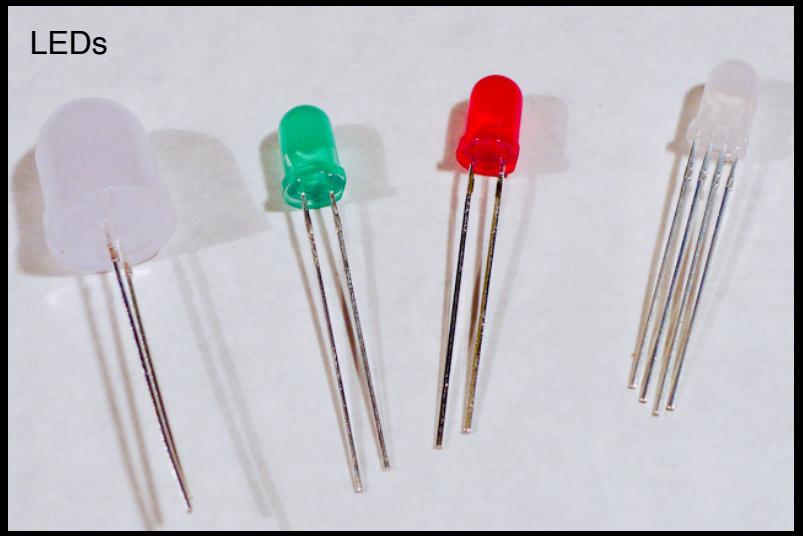
Servo Motor



DC Motor

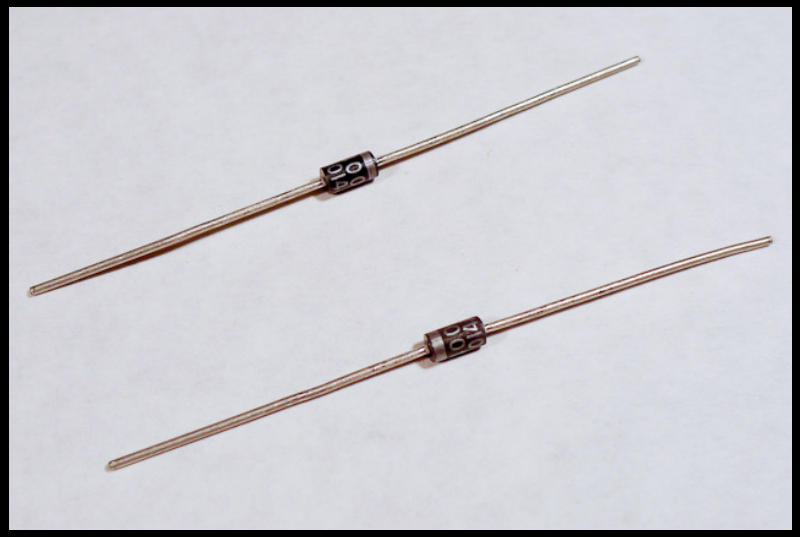


LEDs

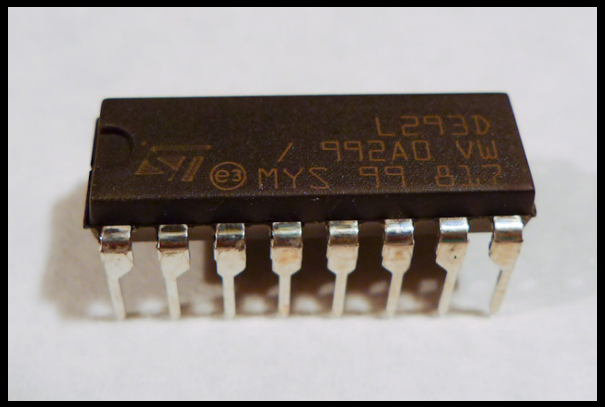


Other Components

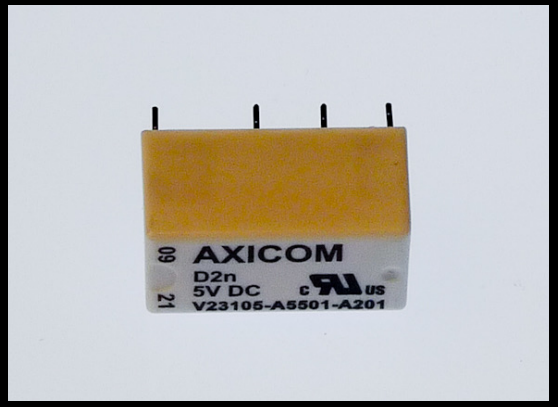
Capacitors



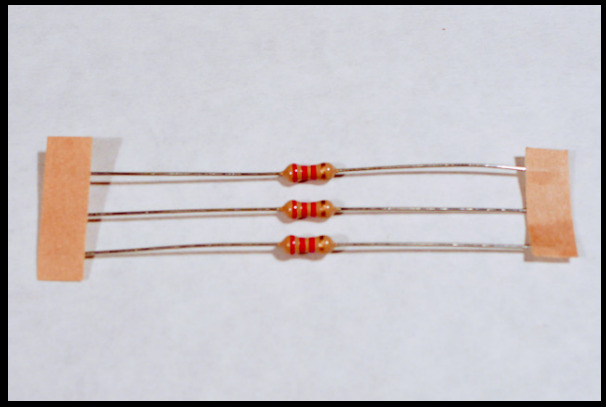
Diodes



H-Bridge

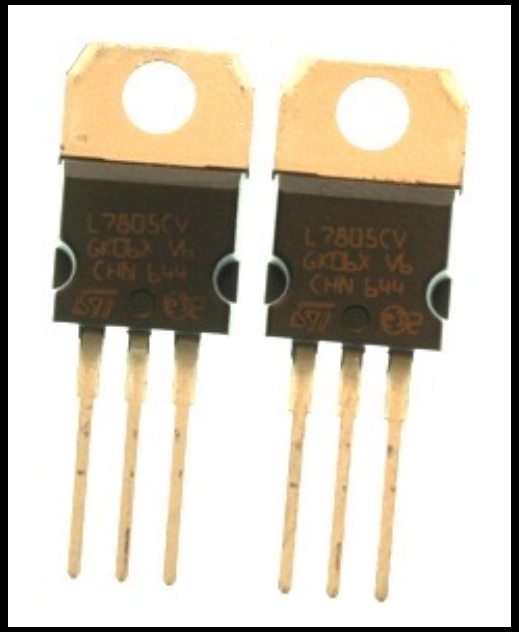


Relay

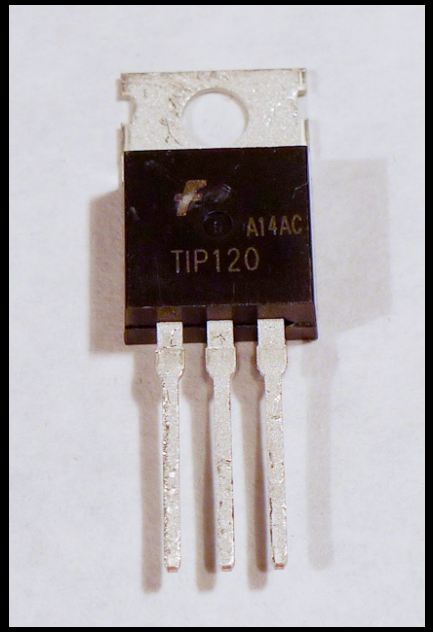


Resistor

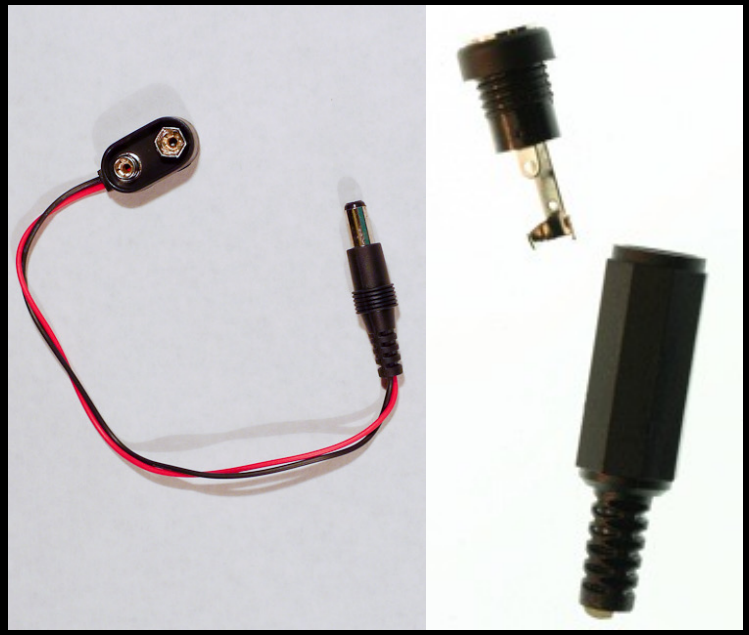
Other Components



5V Voltage Regulator



Transistor

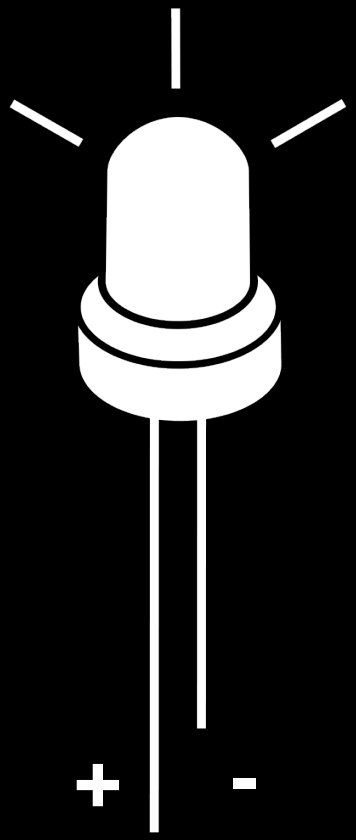


Power Connectors

Polarity

Electric current can only run in one direction through the component.

- LEDs
- Diodes
- Some capacitors



Datasheet

- Max and min current/voltage
- Input and output connections
- Polarity
- Dimensions

Kingbright®

T- 1 3/4 (5mm) SUPER BRIGHT LED LAMPS

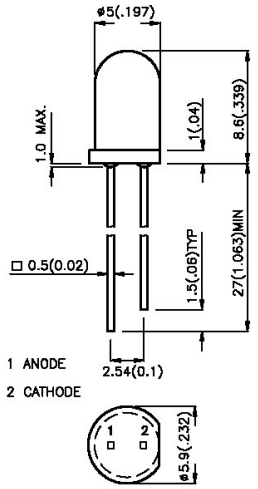
L-53SG SUPER BRIGHT GREEN

L-53SR SUPER BRIGHT RED

Features

- ULTRA BRIGHTNESS.
- BOTH DIFFUSED AND WATER CLEAR LENS ARE AVAILABLE.
- OUTSTANDING MATERIAL EFFICIENCY.
- RELIABLE AND RUGGED.
- IC COMPATIBLE/LOW CURRENT CAPABILITY.

Package Dimensions



Description

The Super Bright Green source color devices are made with Gallium Phosphide Green Light Emitting Diode.

The Super Bright Red source color devices are made with Gallium Aluminum Arsenide Red Light Emitting Diode.

Notes:
1. All dimensions are in millimeters (inches).
2. Tolerance is ±0.25(0.01") unless otherwise noted.
3. Lead spacing is measured where the lead emerge package.
4. Specifications are subjected to change without notice.

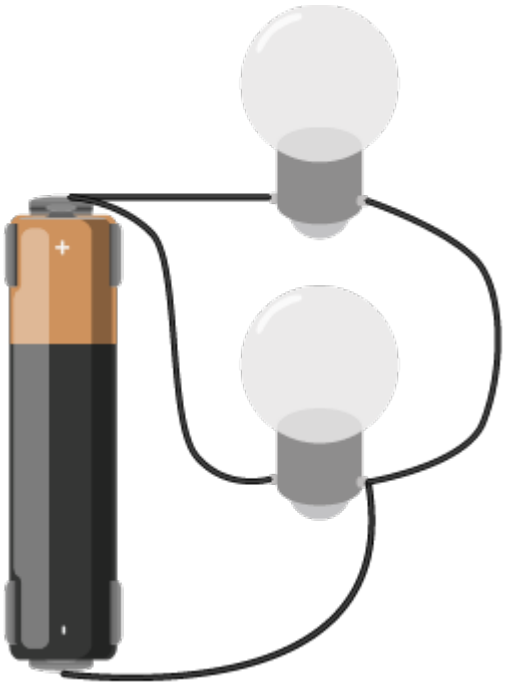
Selection Guide

Part No.	Dice	Lens Type	Iv (mcd) @ 20 mA		Viewing Angle
			Min.	Max.	2θ1/2
L-53SGC	SUPER BRIGHT GREEN (GaP)	WATER CLEAR	100	300	30°
L-53SRC-A	SUPER BRIGHT RED (GaAlAs)	WATER CLEAR	300	400	
L-53SRC-B			400	500	
L-53SRC-C			500	1000	
L-53SRC-DU			1000	1300	
L-53SRC-DV			1300	1600	
L-53SRC-DW			1600	2000	
L-53SRC-E			2000	3500	
L-53SRC-F			3500	4500	
L-53SGD	SUPER BRIGHT GREEN (GaP)	GREEN DIFFUSED	20	60	60°
L-53SRD-B	SUPER BRIGHT RED (GaAlAs)	RED DIFFUSED	90	110	
L-53SRD-C			110	200	
L-53SRD-D			200	300	
L-53SRD-E			300	500	
L-53SRD-F			500	700	
L-53SRD-G			700	1000	
L-53SRD-H			1000	1600	

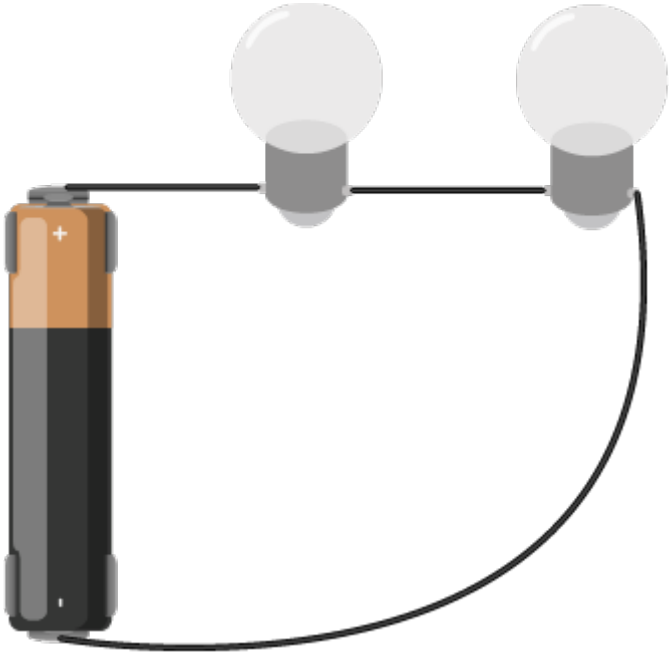
Note:
1. θ1/2 is the angle from optical centerline where the luminous intensity is 1/2 the optical centerline value.

Parallel vs Series

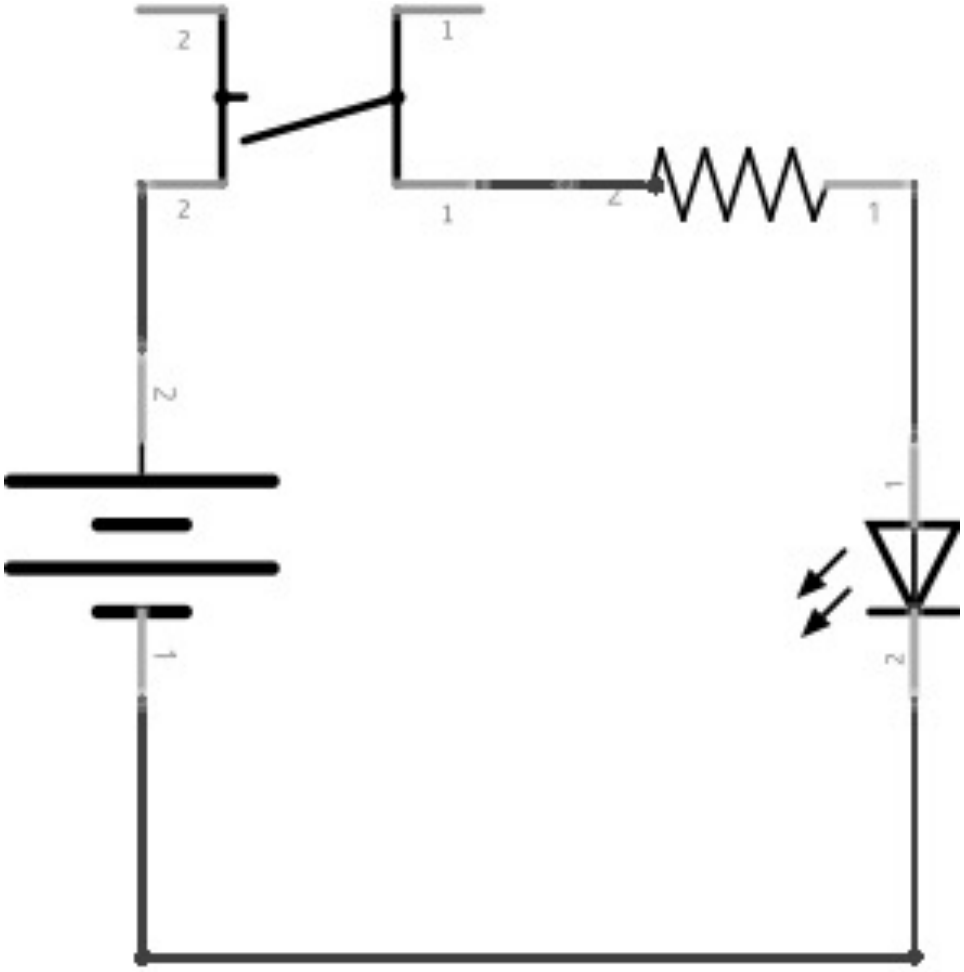
Circuit in Parallel



Circuit in Series



Schematics



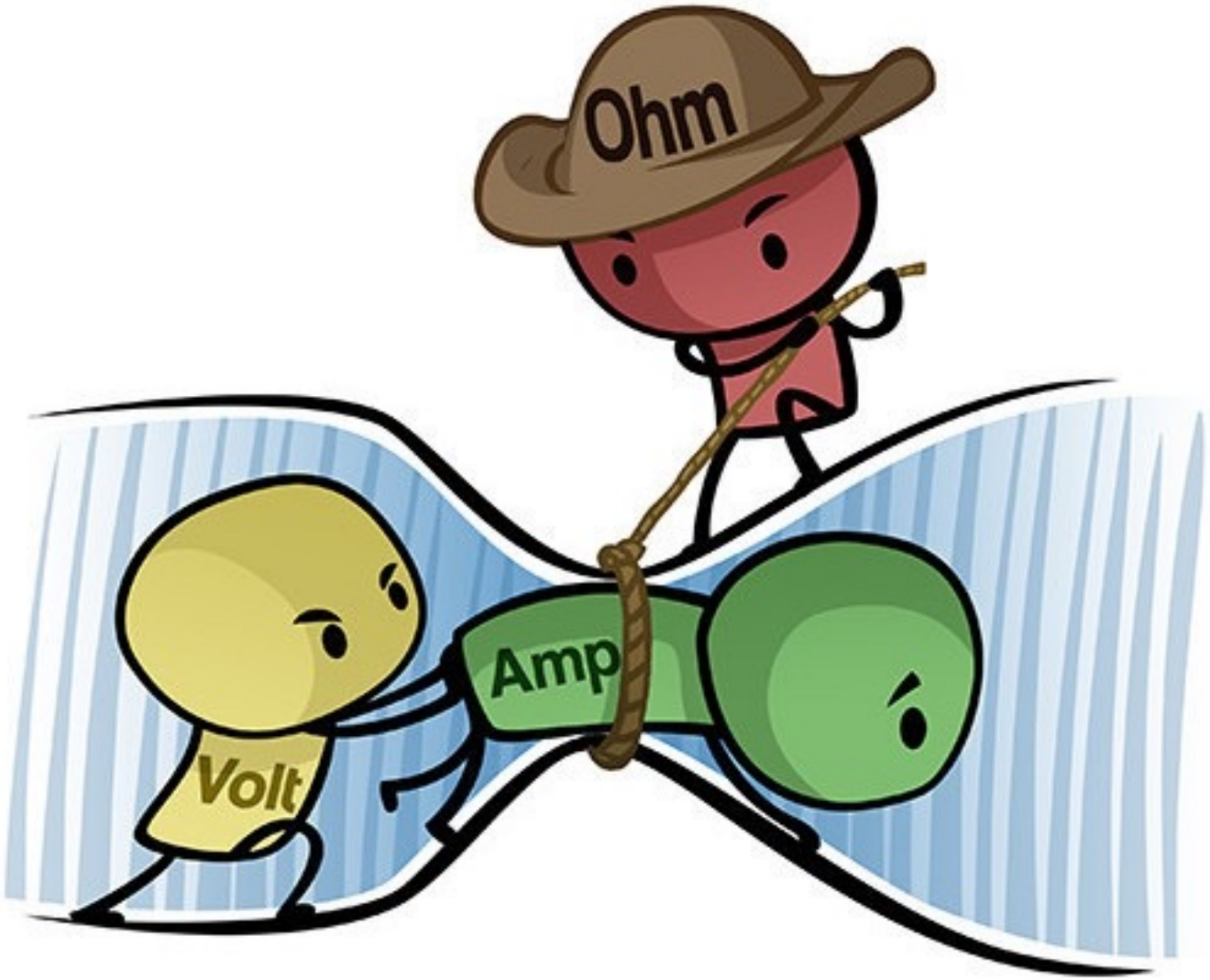
Electricity 101

Voltage: Measure of the difference in electric potential energy between two points in a circuit. (Volts)

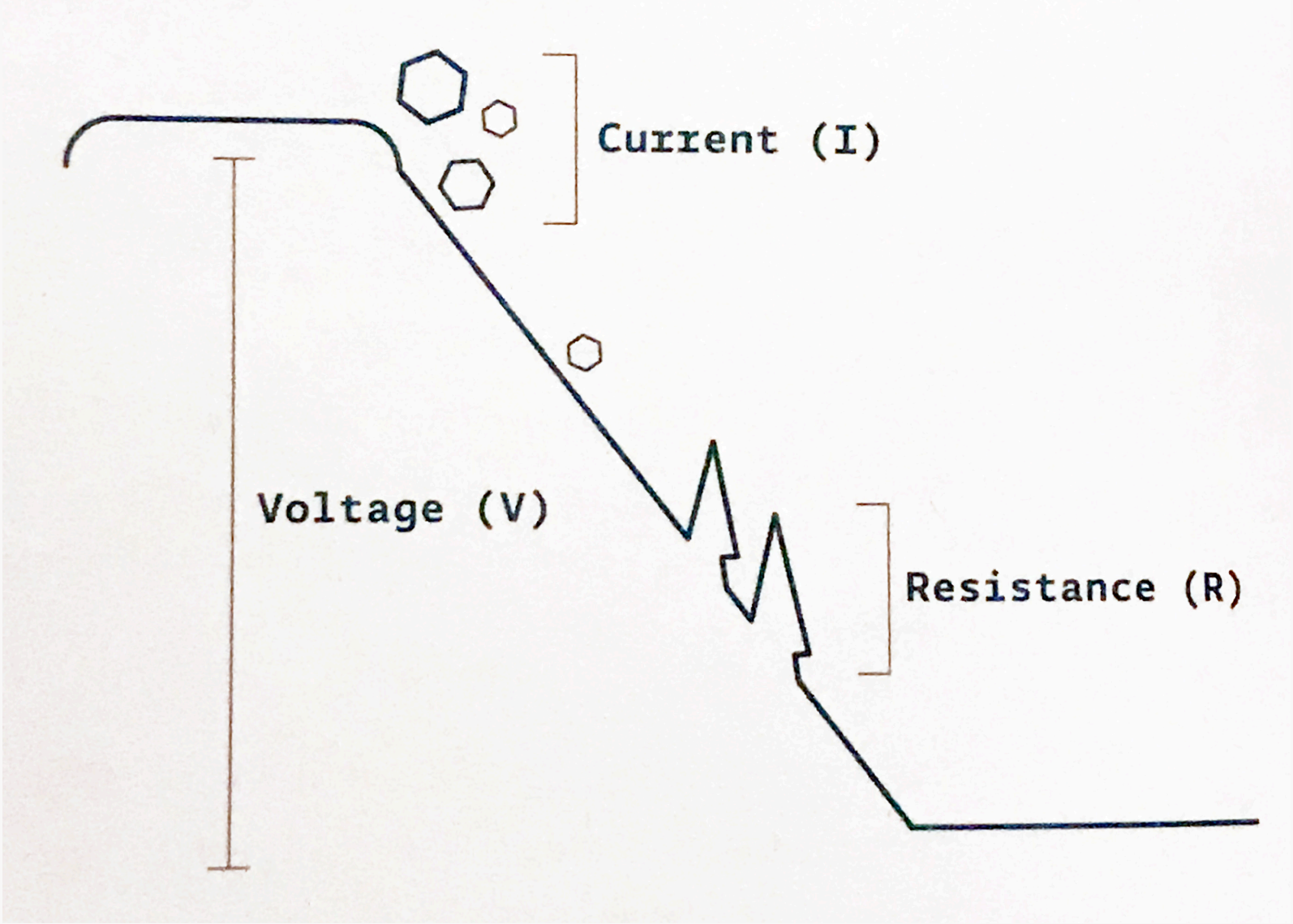
Current: Measure of the magnitude of the flow of electrons. (Amps)

Resistance: Measure of a materials ability to oppose the flow of electricity. (Ohms)

Electricity 101



Electricity 101



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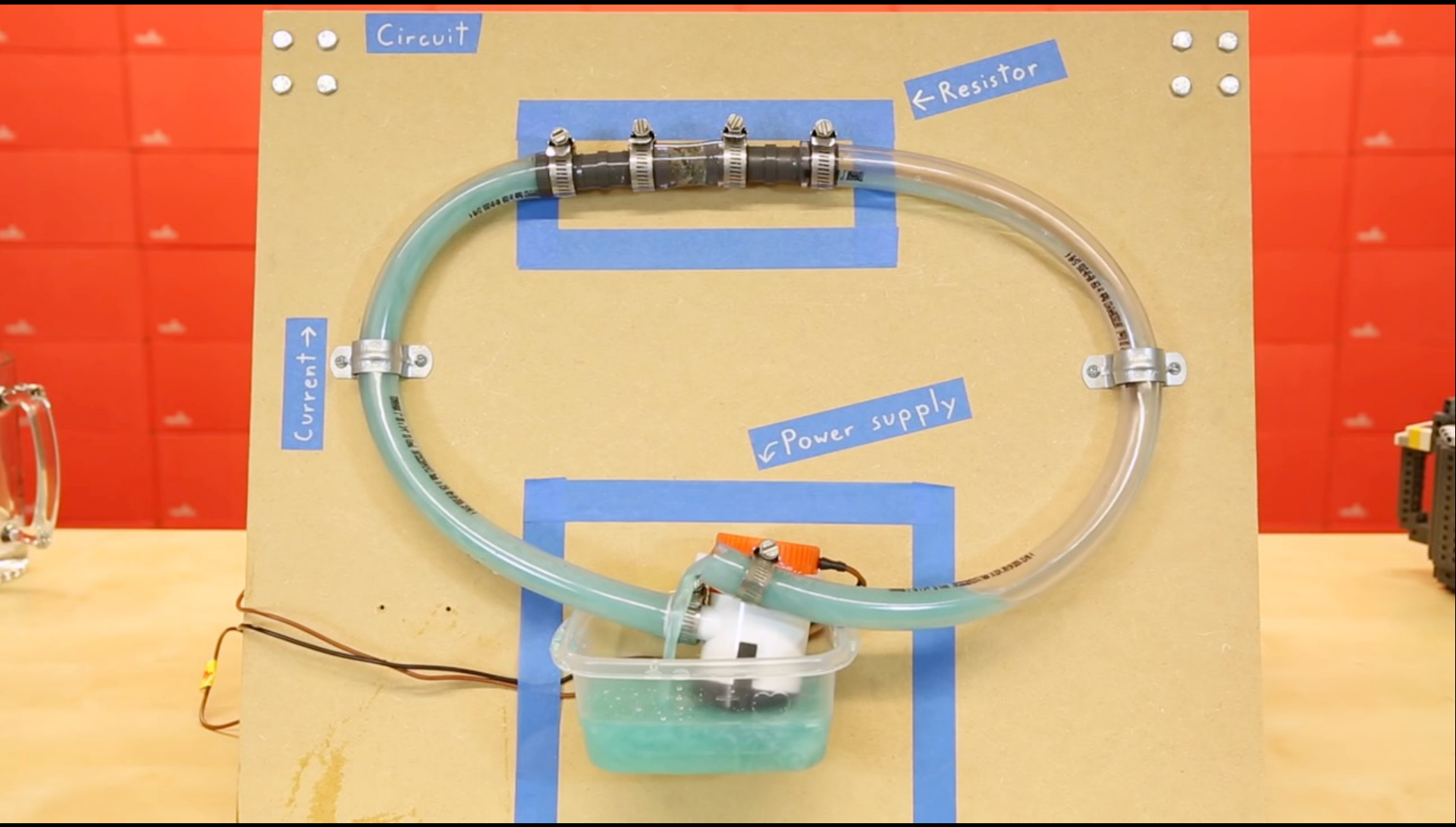
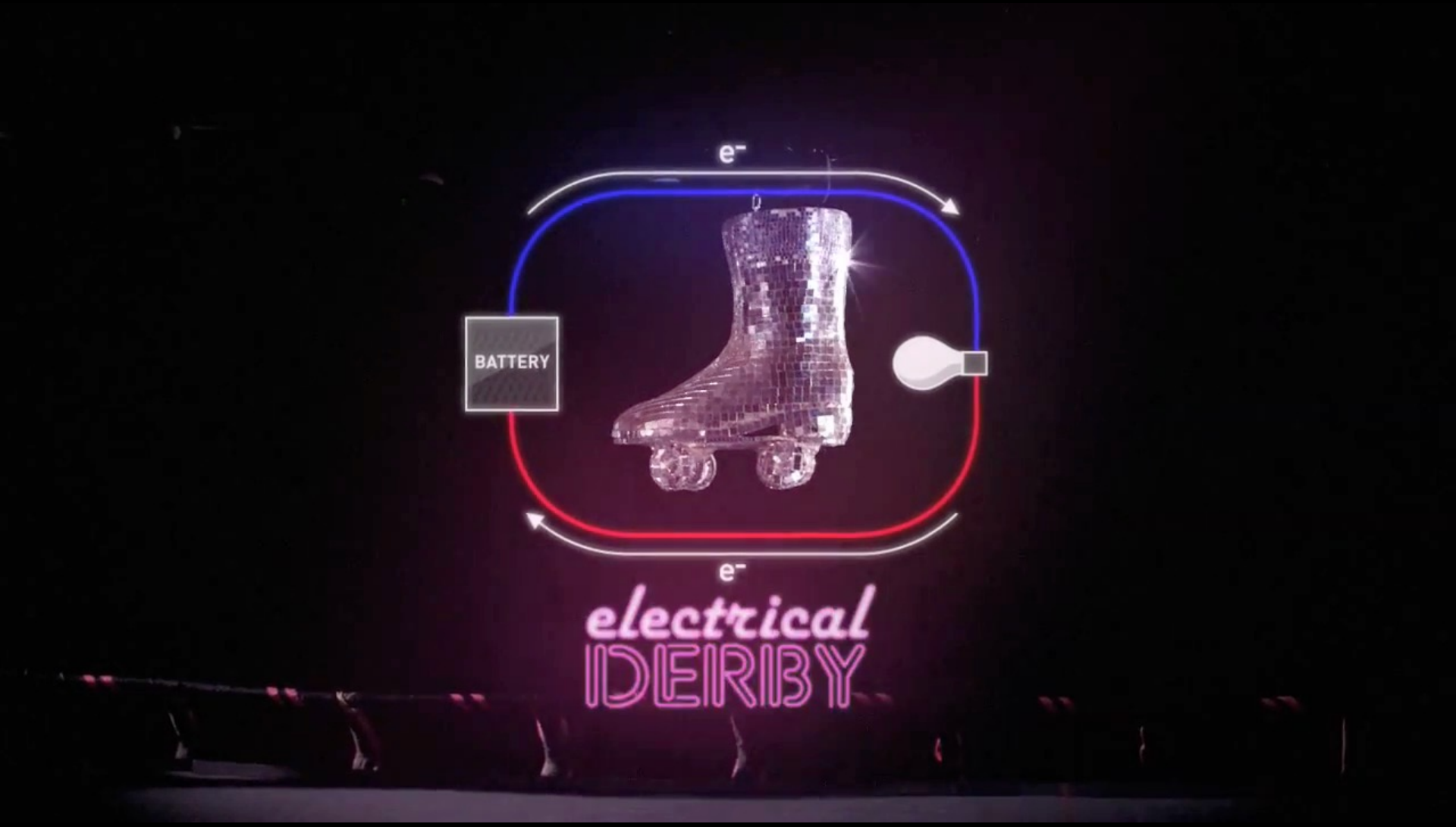
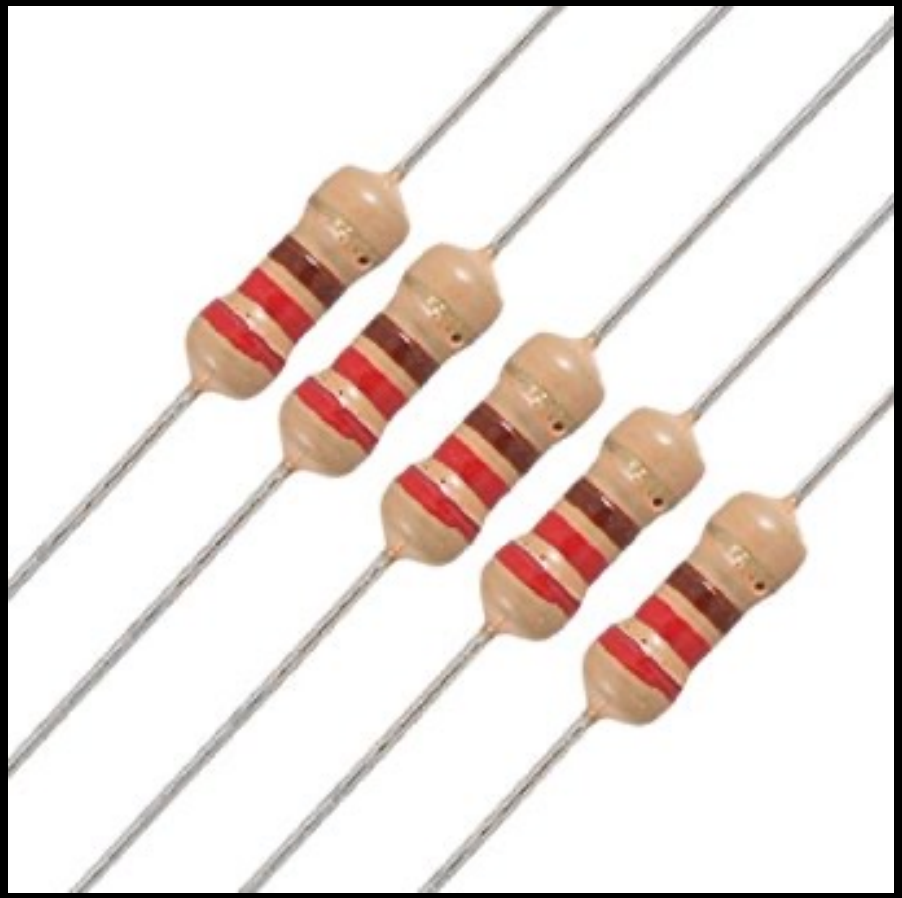


Electricity 101



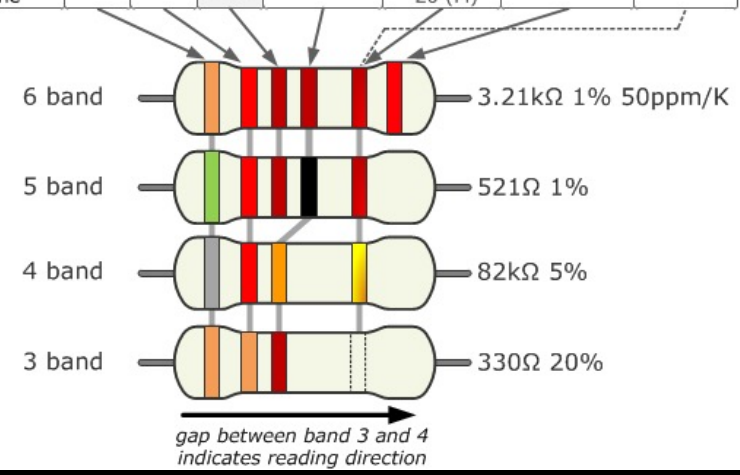
https://www.youtube.com/watch?v=sQ9G2OL9ERo

Resistors

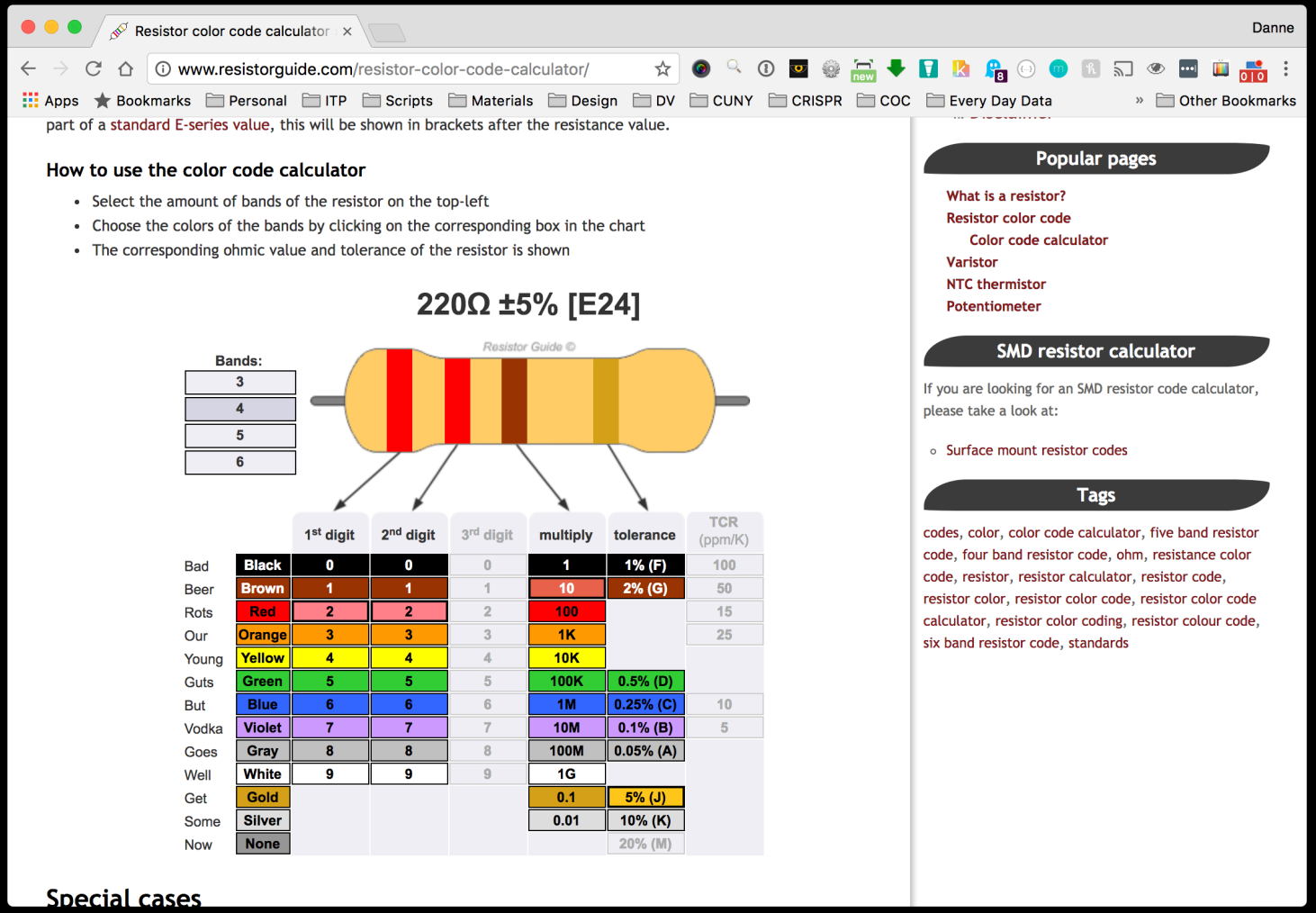


www.resistorguide.com

	Color	Signficant figures			Multiply	Tolerance (%)	Temp. Coeff. (ppm/K)	Fail Rate (%)
Bad	black	0	0	0	x 1		250 (U)	
Beer	brown	1	1	1	x 10	1 (F)	100 (S)	1
Rots	red	2	2	2	x 100	2 (G)	50 (R)	0.1
Our	orange	3	3	3	x 1K		15 (P)	0.01
Young	yellow	4	4	4	x 10K		25 (Q)	0.001
Guts	green	5	5	5	x 100K	0.5 (D)	20 (Z)	
But	blue	6	6	6	x 1M	0.25 (C)	10 (Z)	
Vodka	violet	7	7	7	x 10M	0.1 (B)	5 (M)	
Goes	grey	8	8	8	x 100M	0.05 (A)	1(K)	
Well	white	9	9	9	x 1G			
Get	gold			3th digit only for 5 and 6 bands	x 0.1	5 (J)		
Some	silver				x 0.01	10 (K)		
Now!	none					20 (M)		

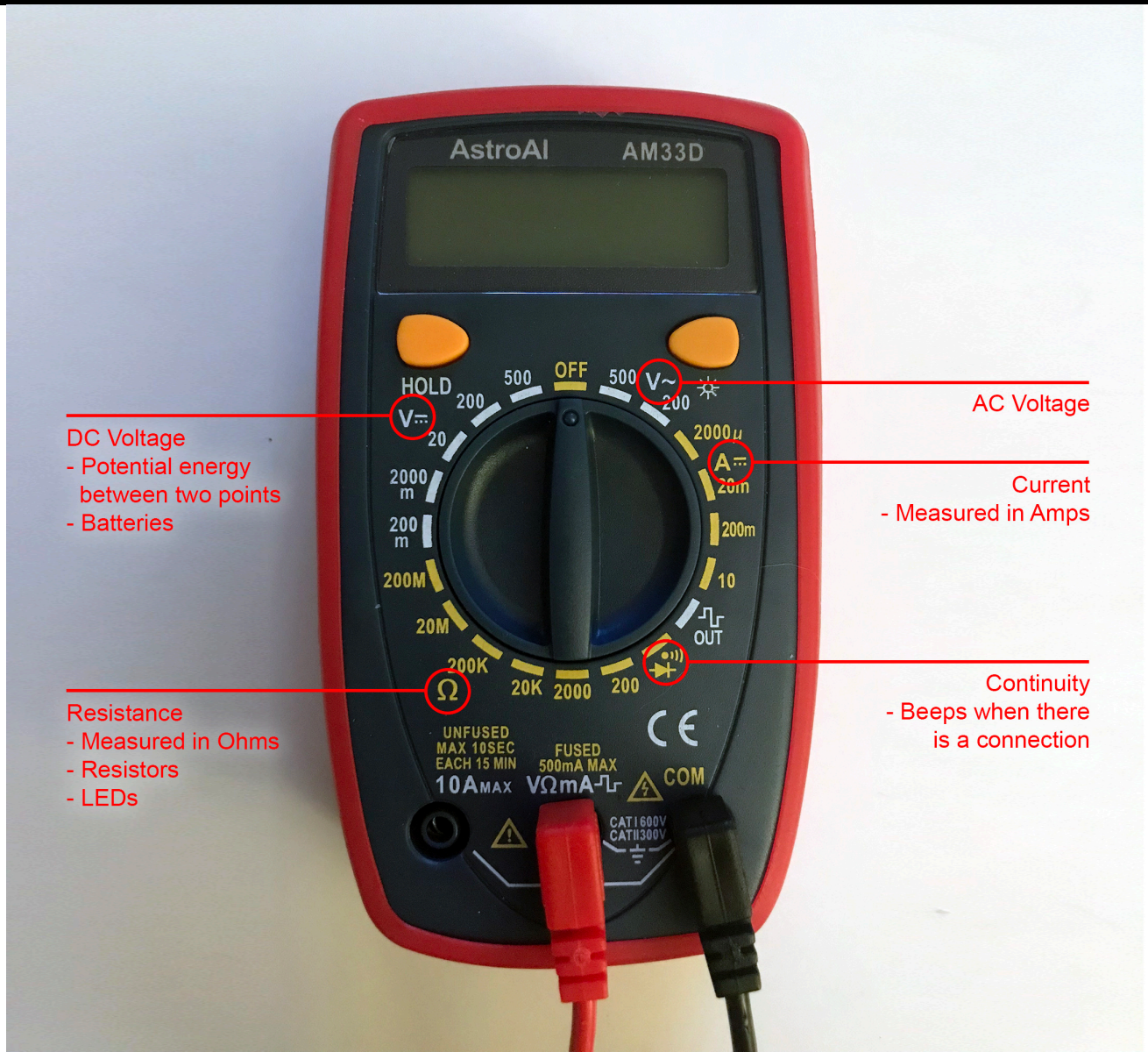


Resistors

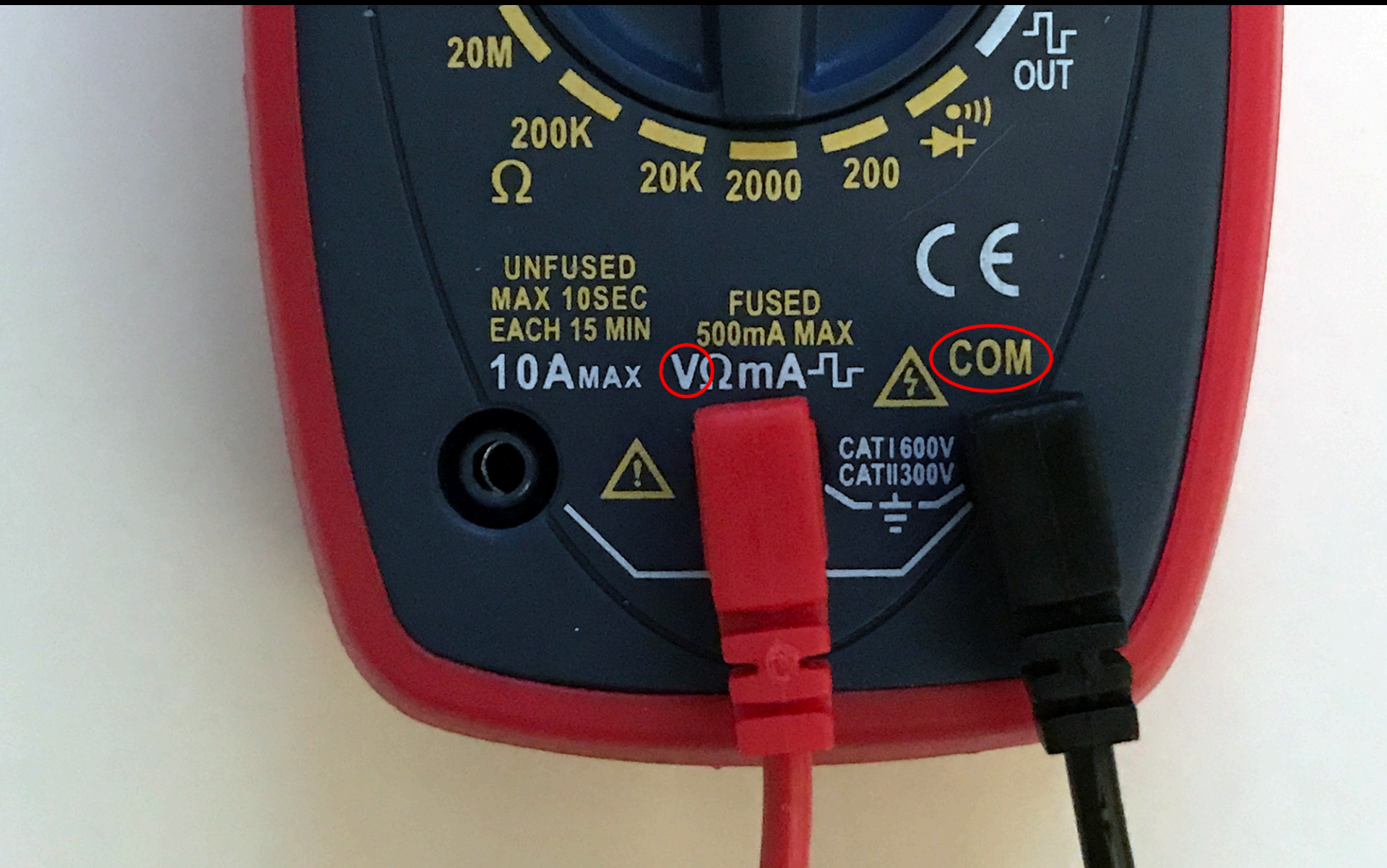


http://www.resistorguide.com/resistor-color-code-calculator/

Digital Multimeter

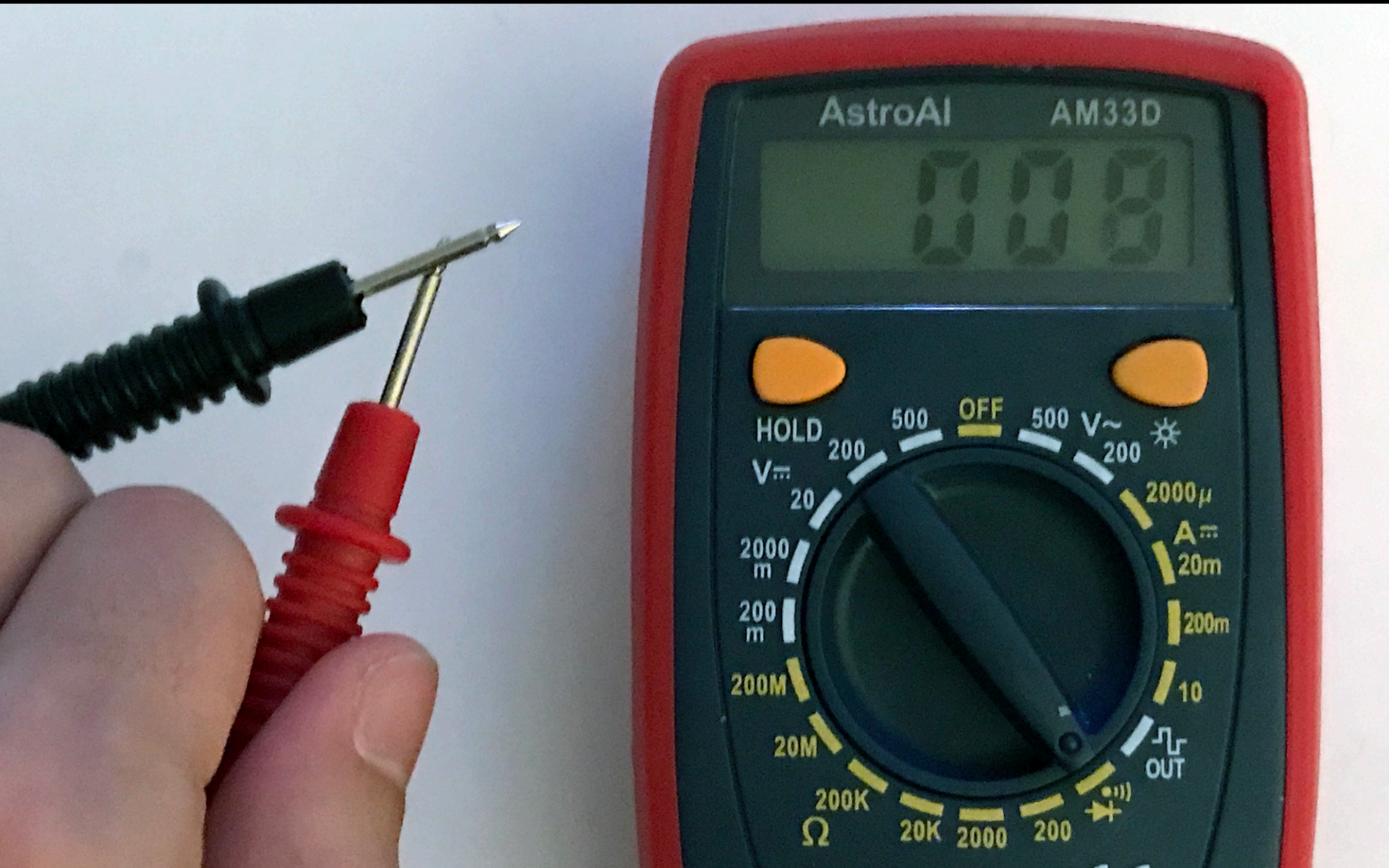


Digital Multimeter

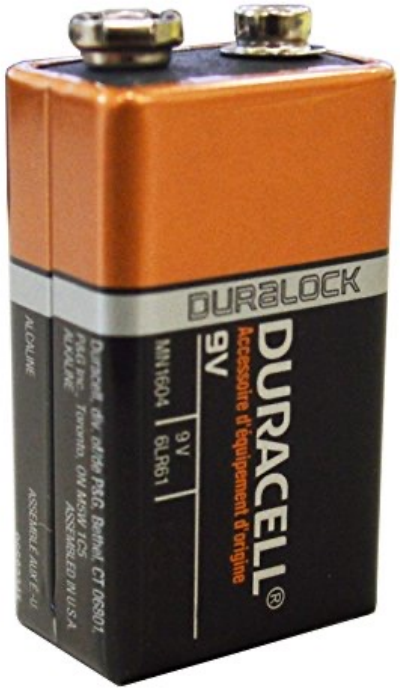


Digital Multimeter – Continuity

Digital Multimeter – Continuity



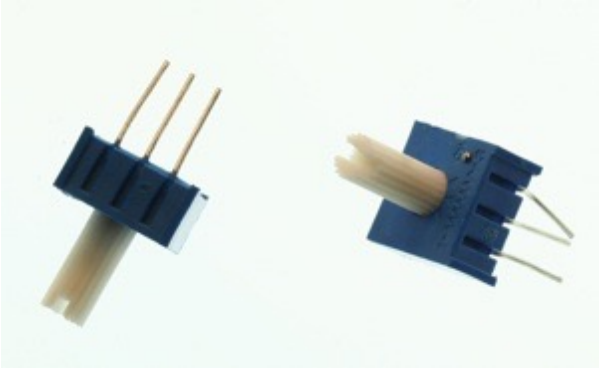
Digital Multimeter – Voltage



Digital Multimeter – Resistance

Resistors

Variable Resistors



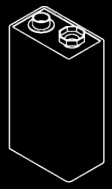
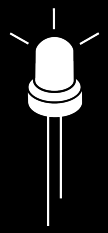
Digital Multimeter – Current

Ohms Law

Voltage (V) **= Current** (I / Amps) **x Resistance** (R / Ohms / Ω)

Ohms Law

Voltage (V) **= Current** (I / Amps) **x Resistance** (R / Ohms / Ω)

 **=**  **x** 

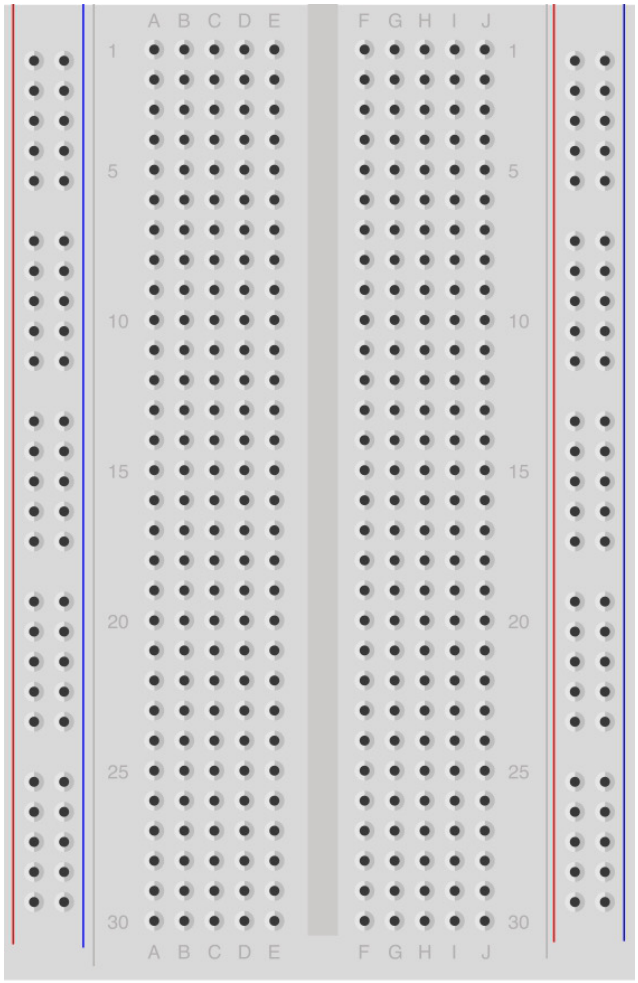
9v **=** **11.5mA** **x** **???**

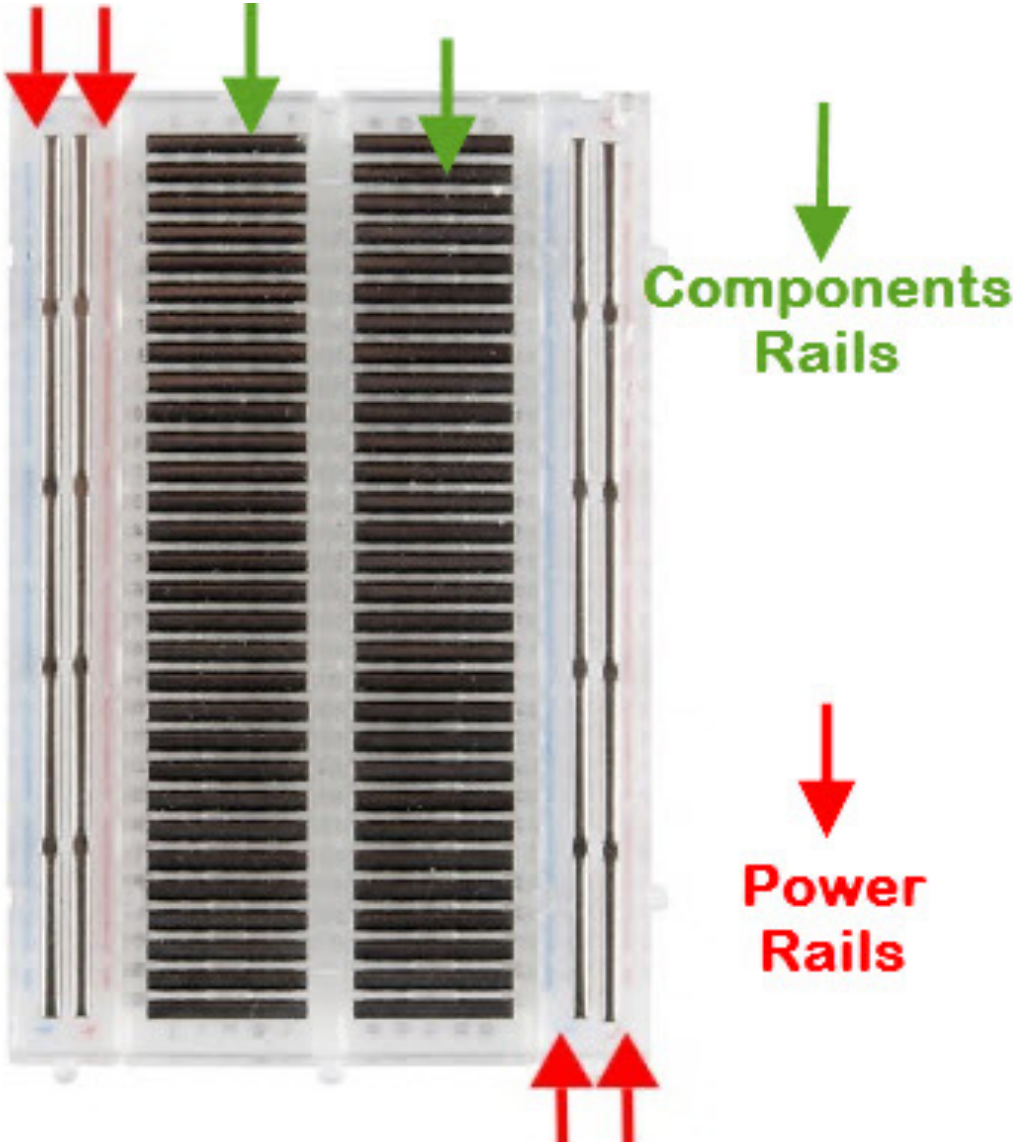
0.0115 amps

$$\frac{9}{0.0115} = 780 \text{ Ohms}$$

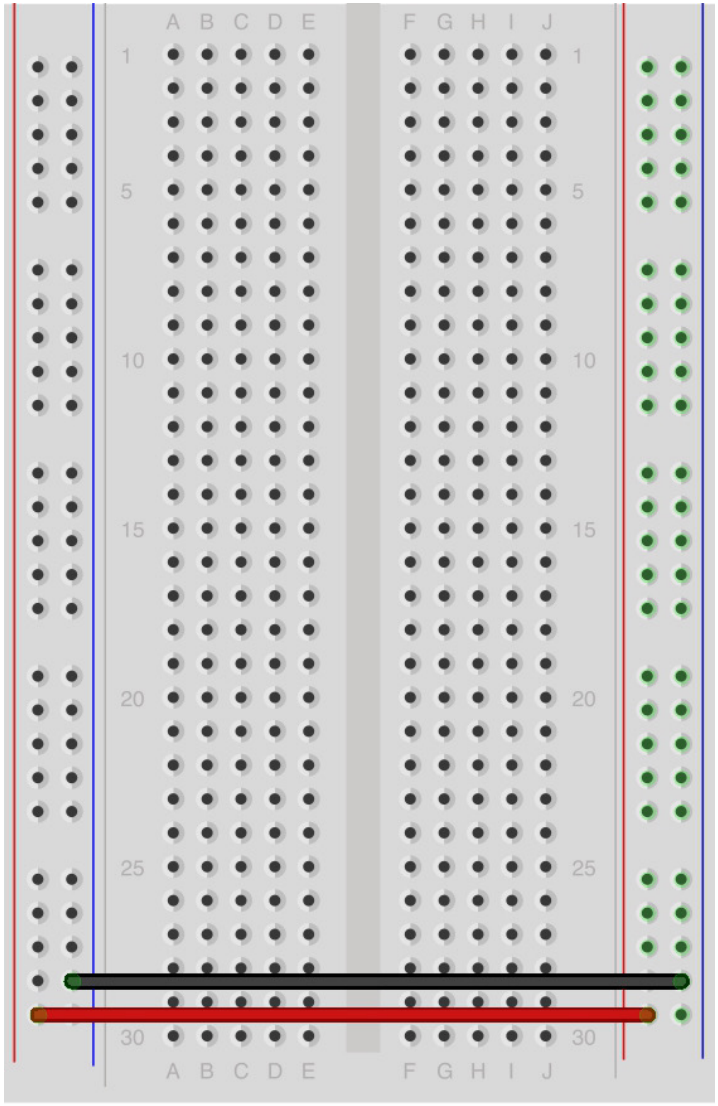
http://www.ohmslawcalculator.com/ohms-law-calculator

Breadboard

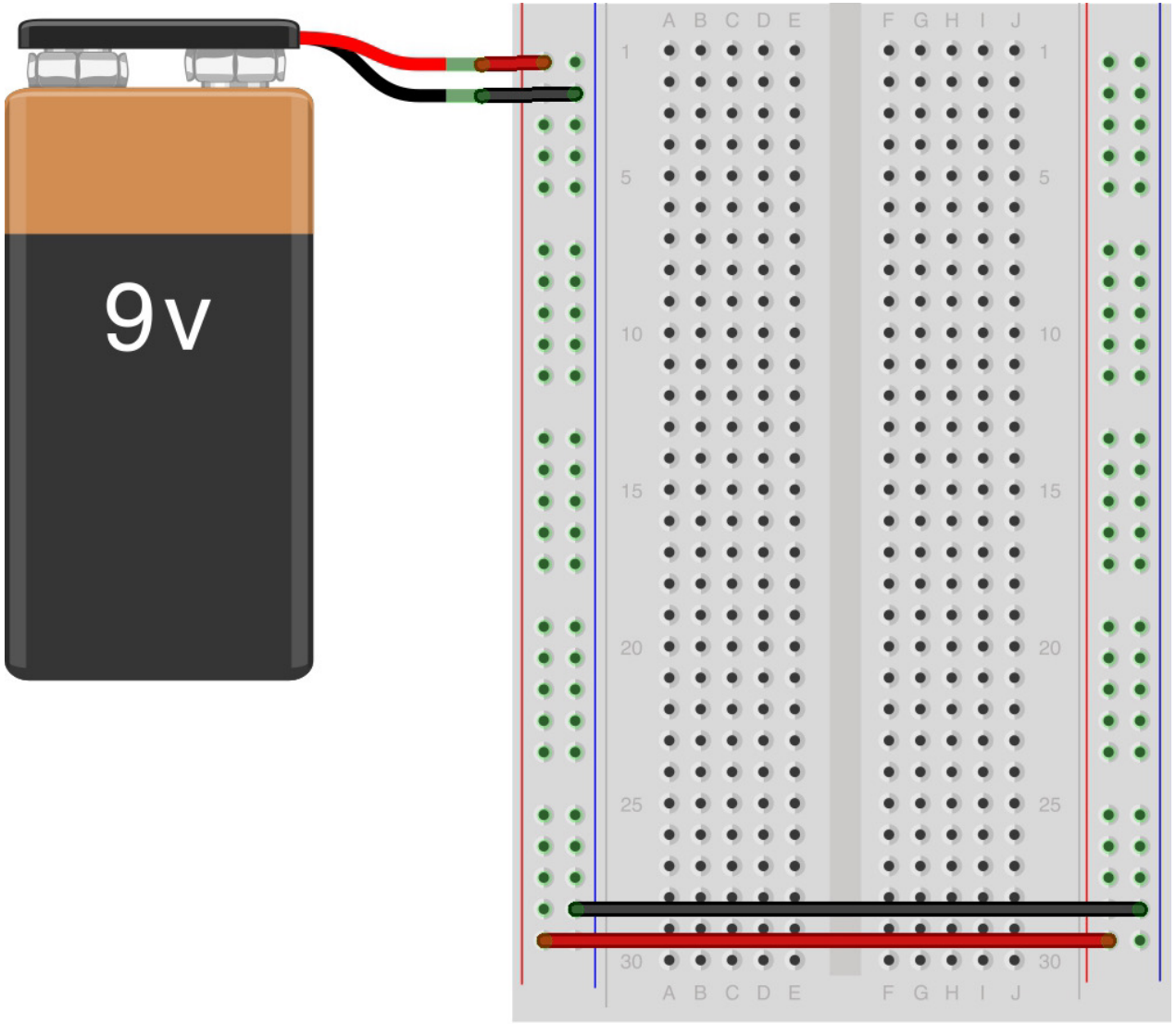




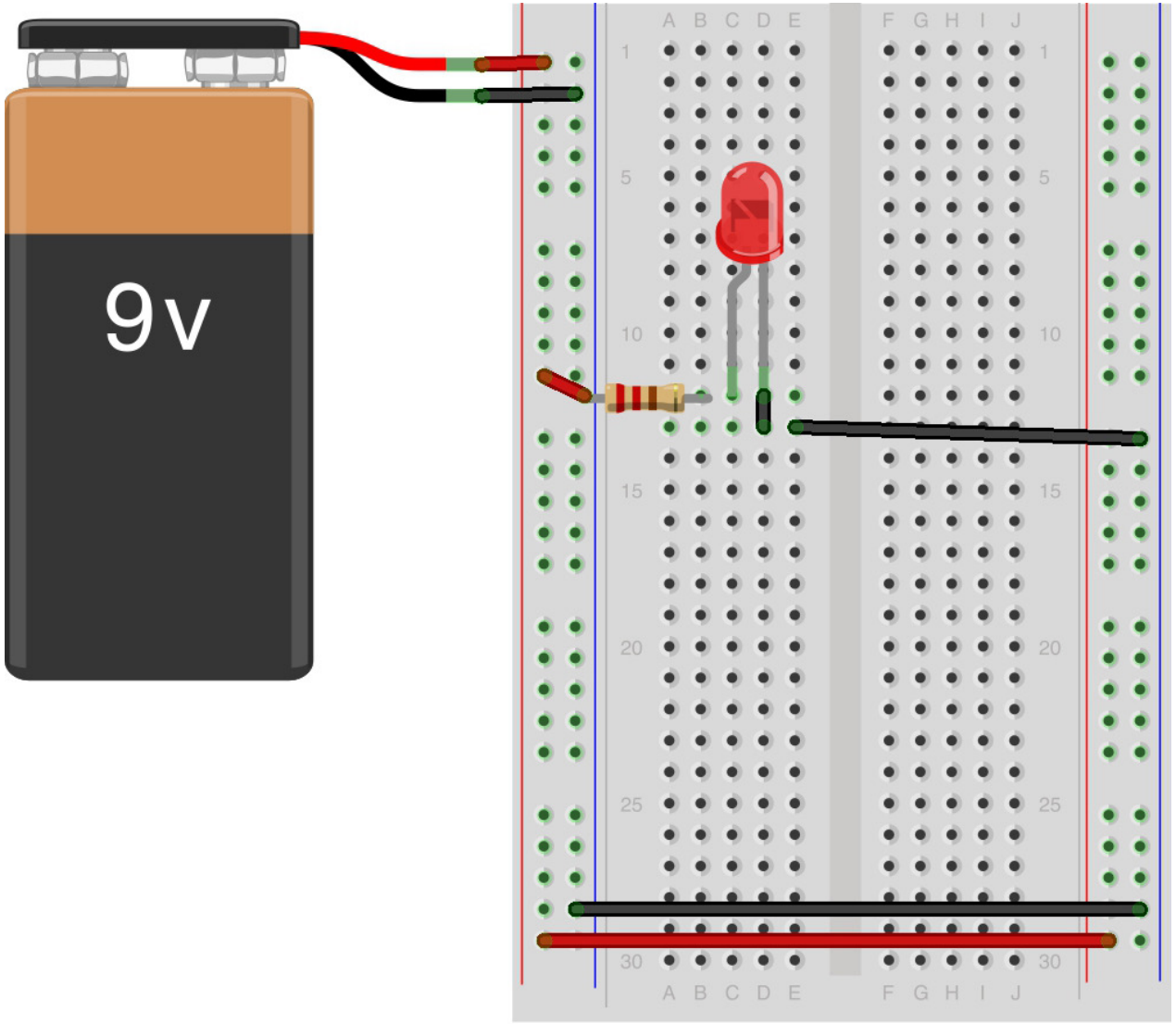
Basic Circuit and Breadboard



Basic Circuit and Breadboard



Basic Circuit and Breadboard



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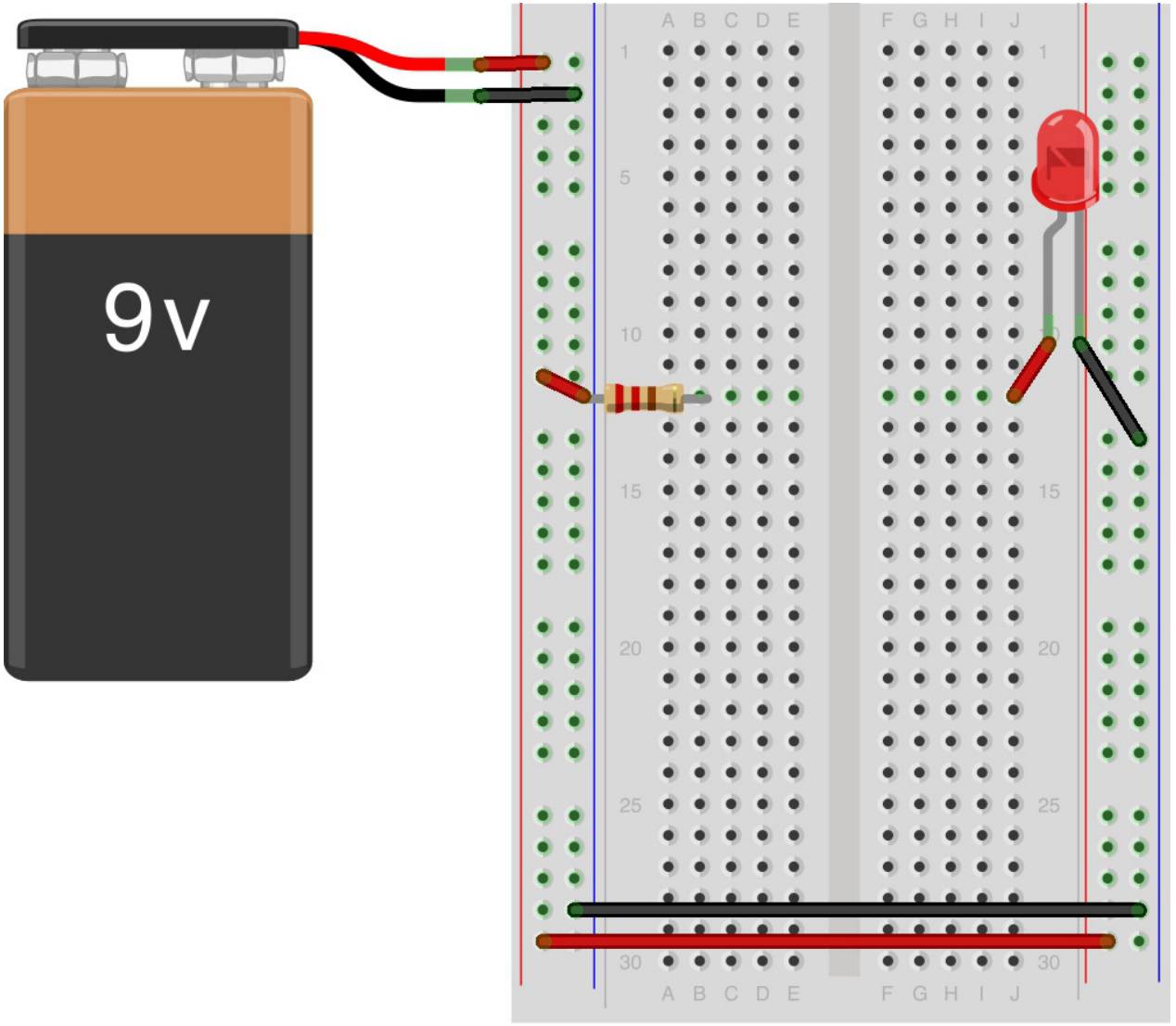
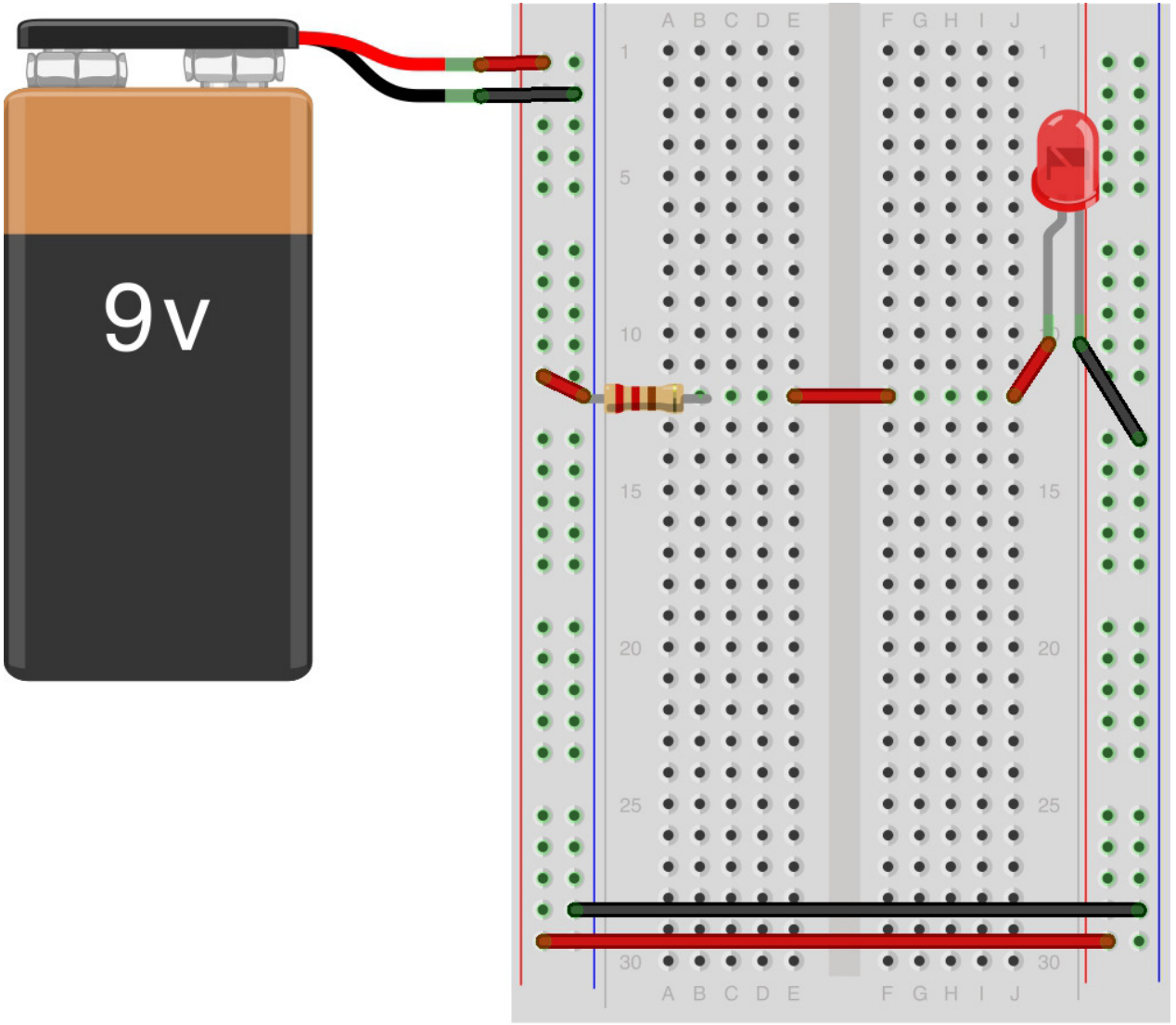
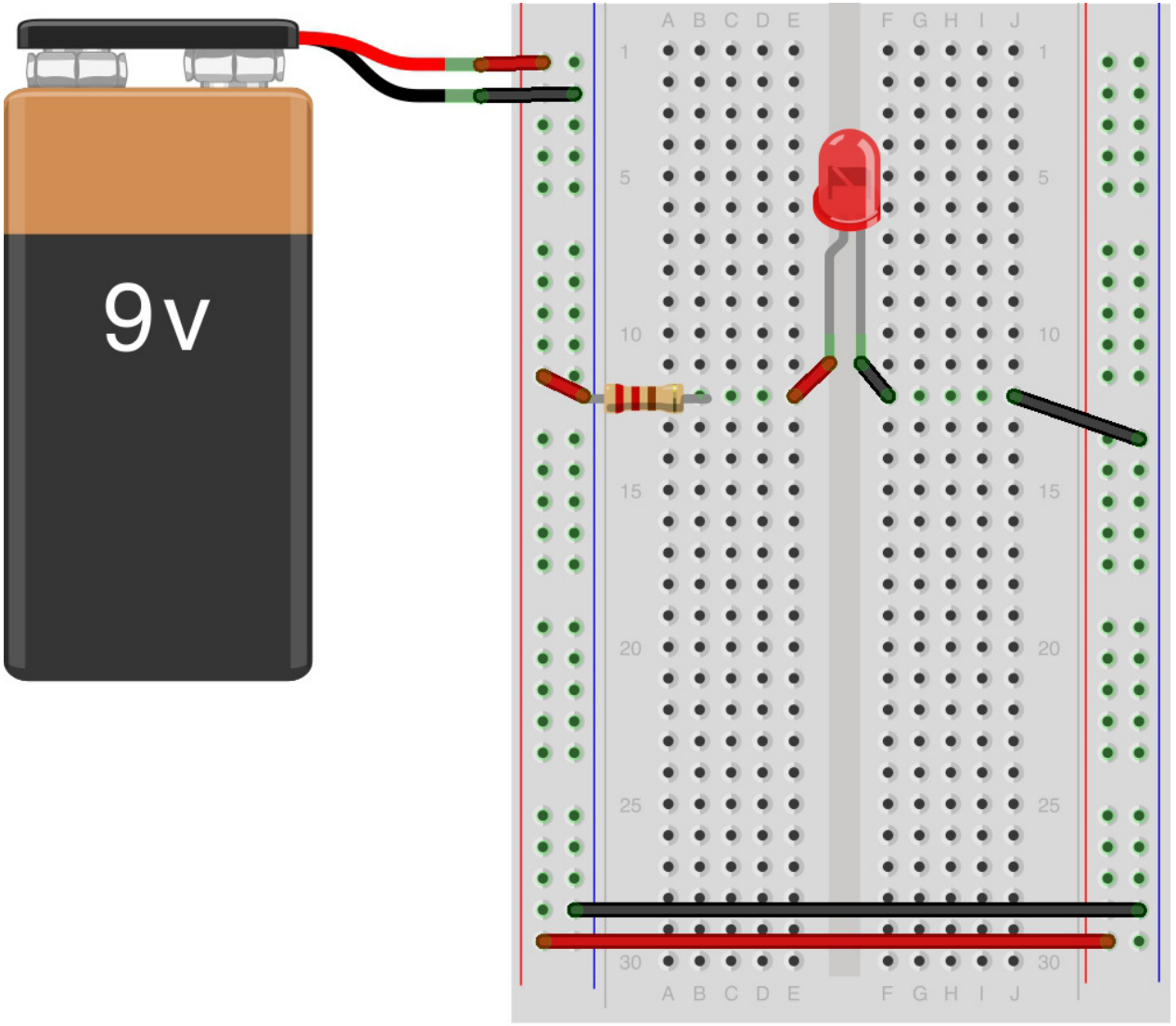


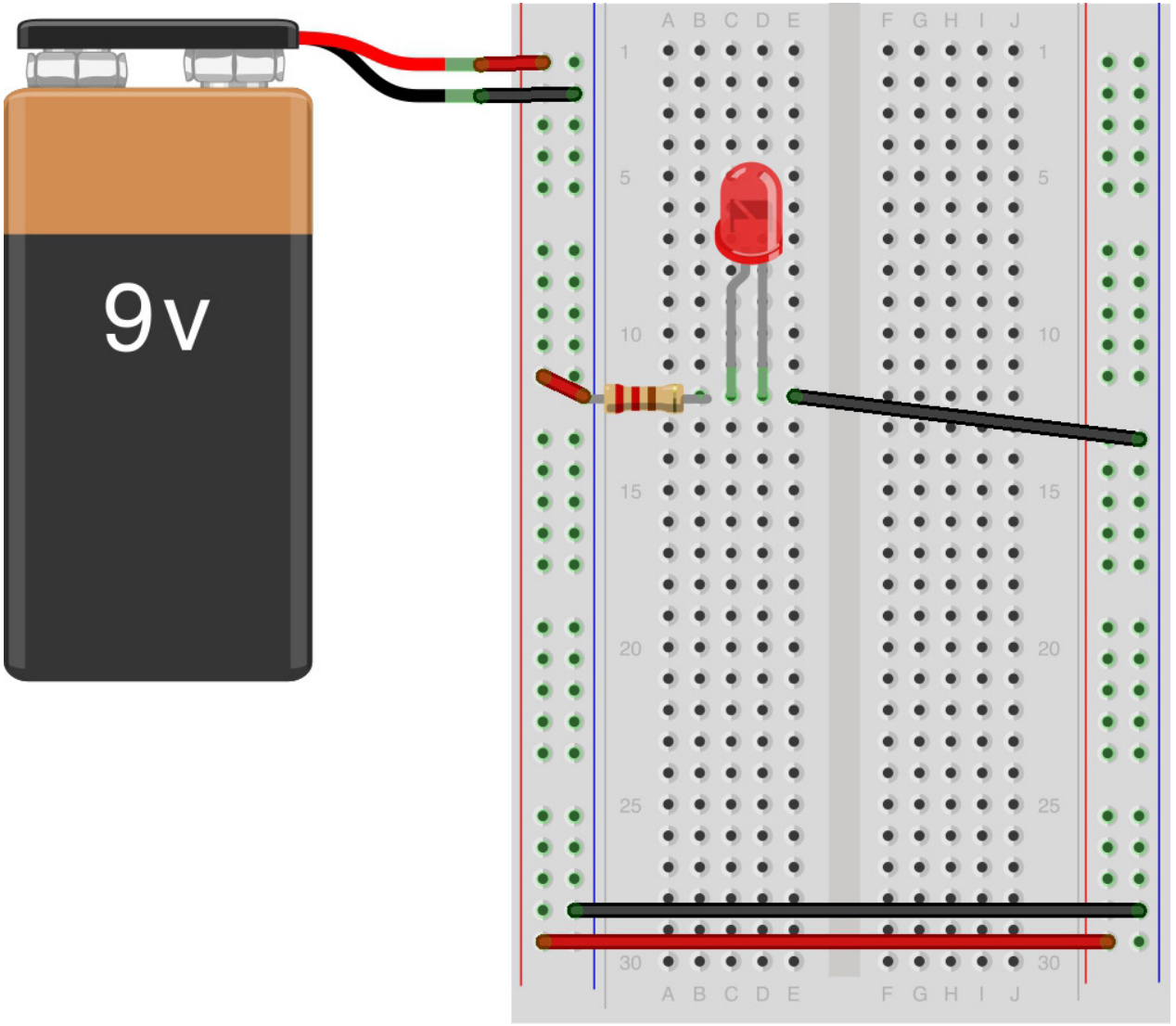
Basic Circuit and Breadboard



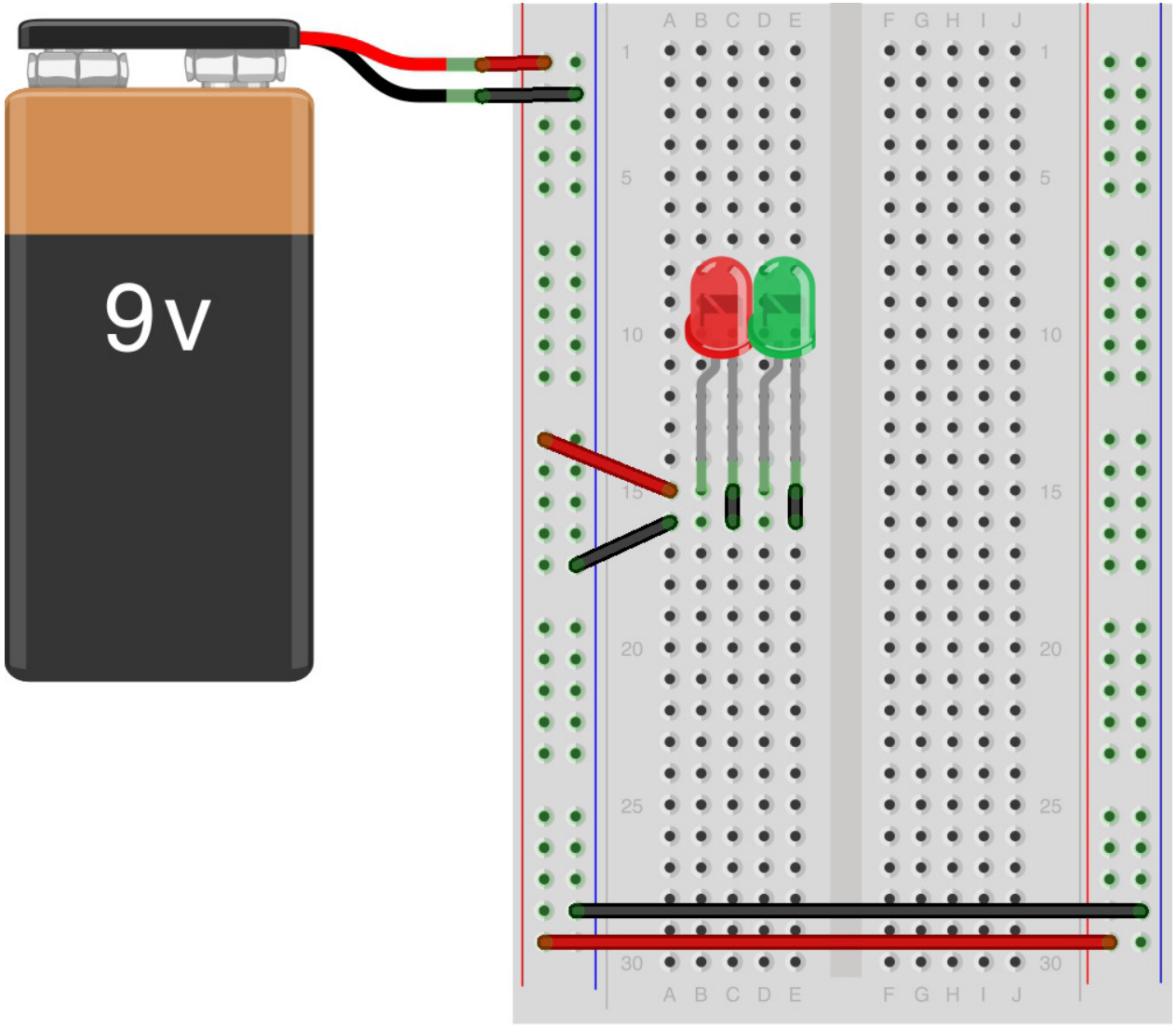
Basic Circuit and Breadboard



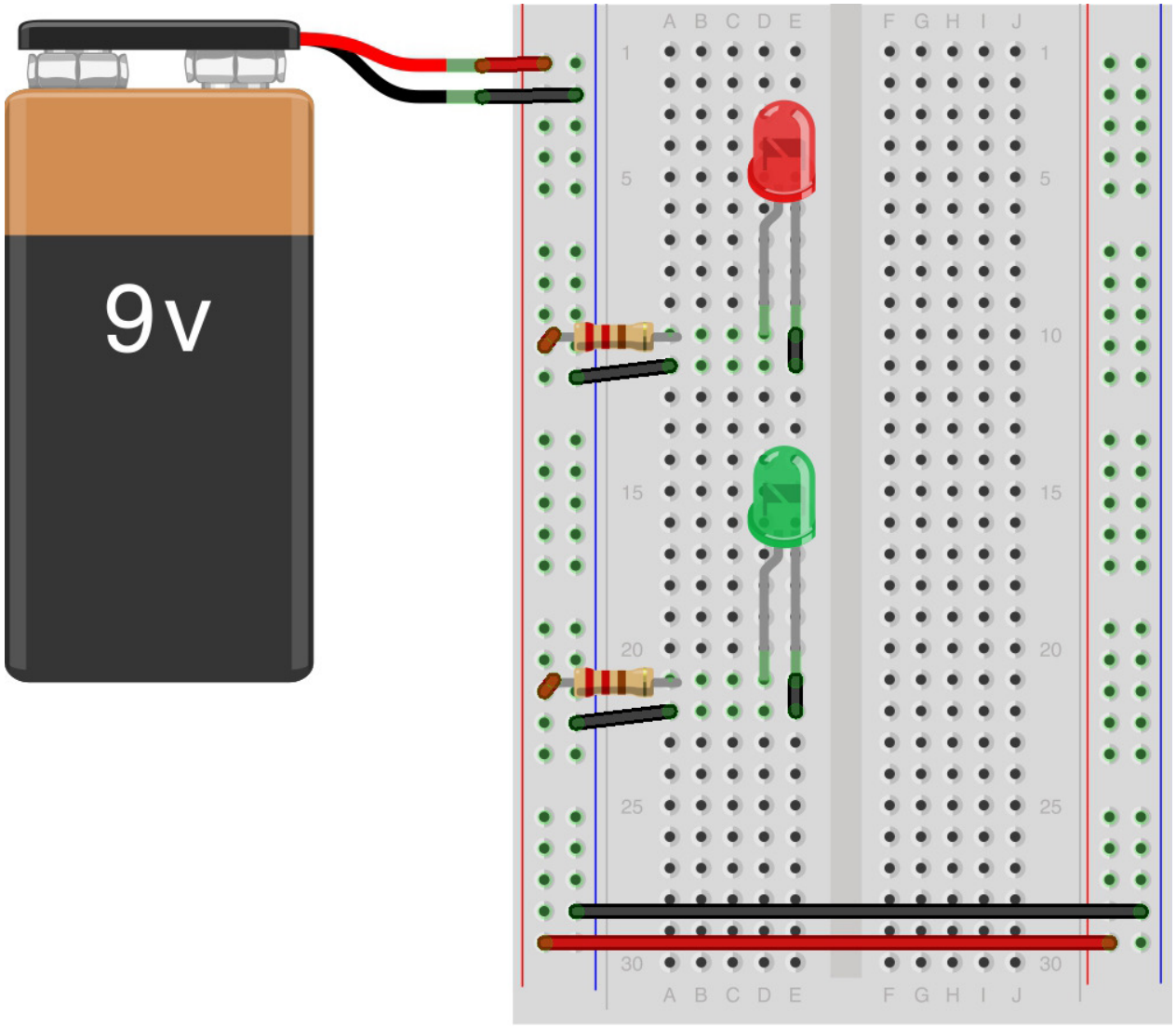
Basic Circuit and Breadboard



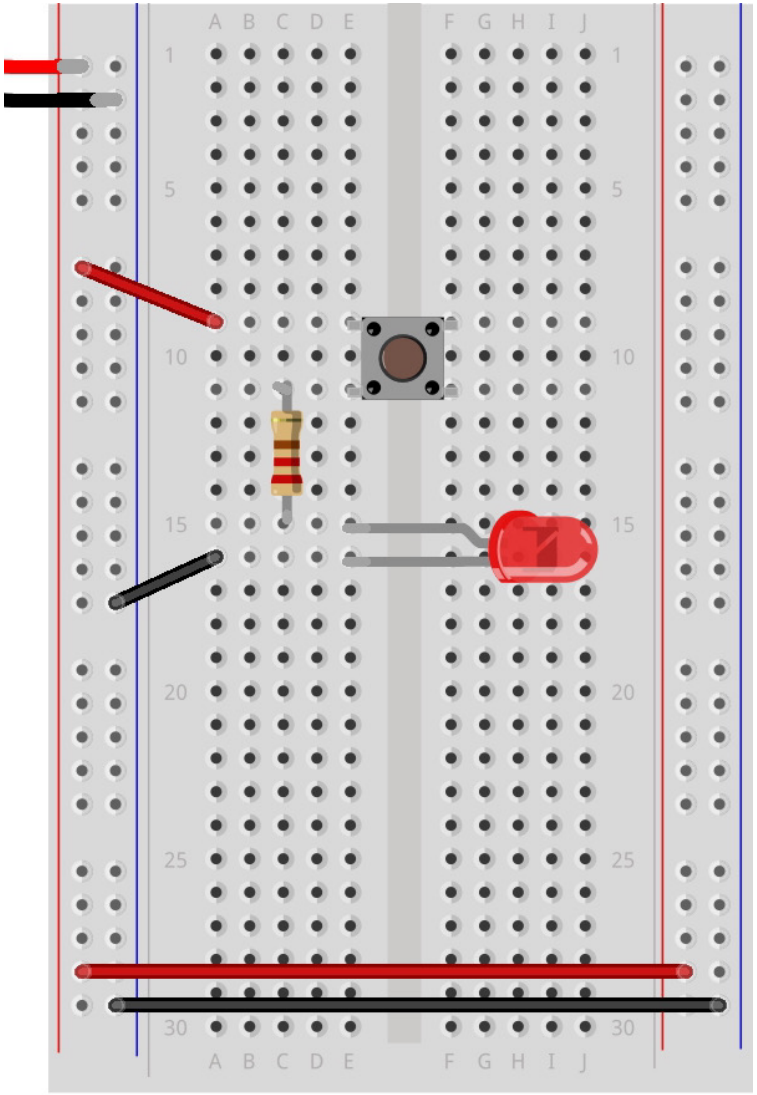
Basic Circuit Series

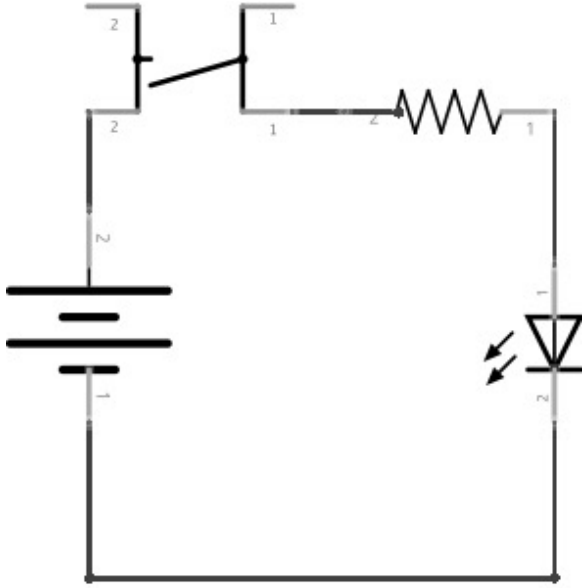


Basic Circuit Parallel

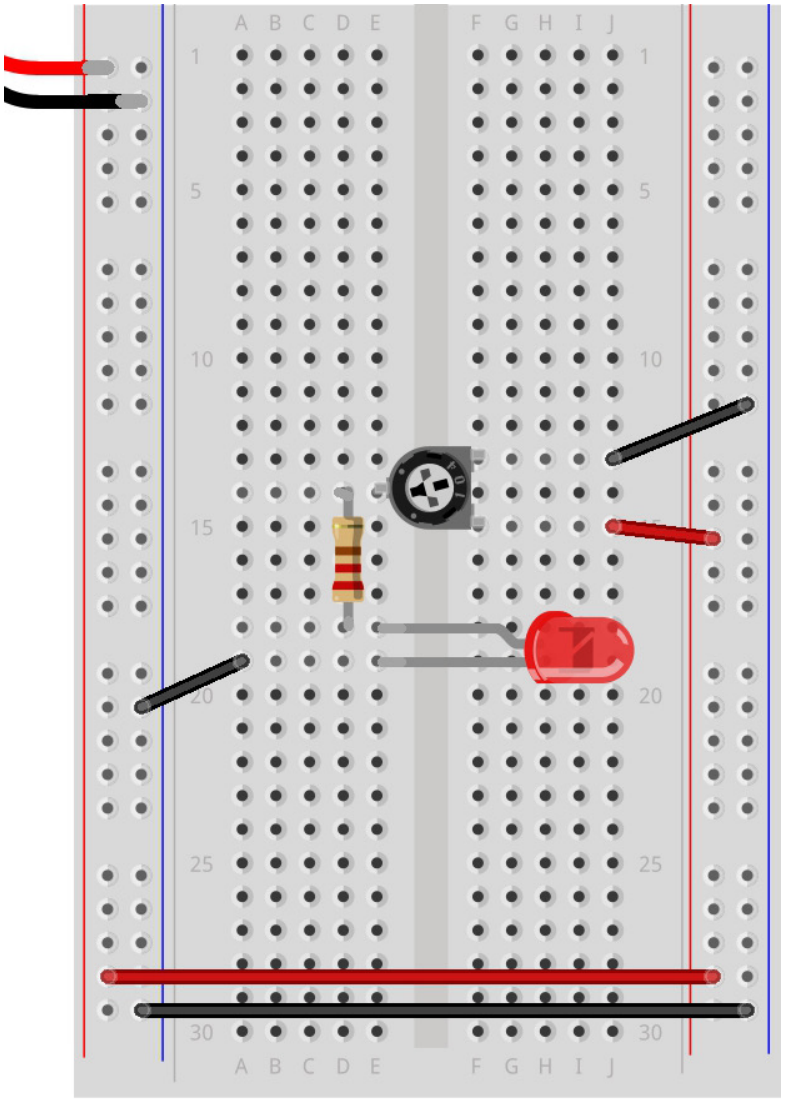


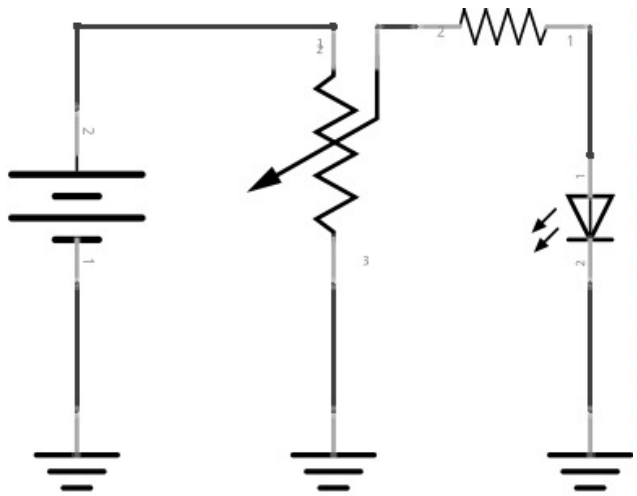
Basic Circuit Switch



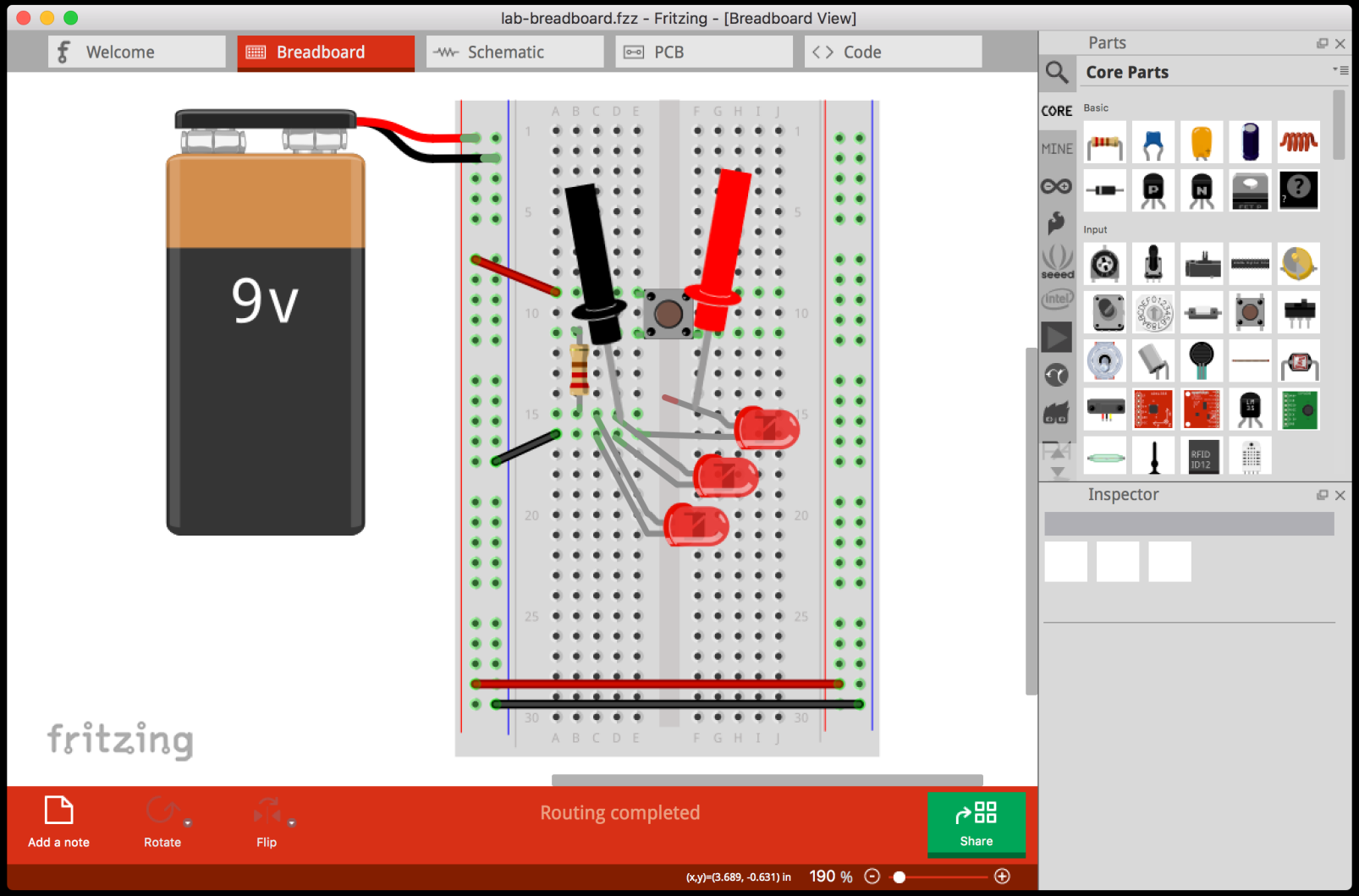


Basic Circuit Potentiometer





Fritzing



http://fritzing.org/

Simple Switches

Review what we covered in class and come up with and build a simple yet creative concept that uses a switch and an LED. Write a blog post about this project.

Homework

1. Finish the in class assignment and post to blog.
2. Read Tom Igoe's, Physical Computing's Greatest Hits (and misses), link is on our website.
3. Look around at all the sensors you interact with on a regular basis, pick one and write a blog post on how you interact with it and how it effects your daily life.

Physical Computing

Professor Danne Woo

danne.woo@qc.cuny.edu

pcomp.dannewoo.com