

# Fair Use Building and Research Labs Presents

Introduction to Electronics and  
Breadboarding Circuits

# What we're going to learn today:

What is an electronic circuit?

What kind of power is needed for these projects?

What are the fundamental principles of electronics?

What are the basic electronic components used in DC analog circuits?

How do these principles combine to make interesting things?

We're going to make some of those things , and you can take the kit, and the projects home with you.

# Fundamentals

Reminder the properties used in electronics were "found" or explained by many different people in the past. The contributions are part of the naming structure for the properties they documented.

Person	Property	Measurement
Alessandro Volta	Voltage	Volts
André-Marie Ampère	Amperes	Amps
James Watt	Watts, Power	Watts
Georg Ohm	Resistance	Ohms
Michael Faraday	Capacitance	Farads

# Class Parts List

Breadboard 1  
Wire kit 1  
Red LEDs 3  
Green LEDs 3  
Yellow LEDs 1  
Photoresistor 1  
xPiezo sensor 1  
Button 3  
Slide button, switch 1  
Reed switch 1  
Potentiometer  
Hall effect sensor 1  
Rare Earth Magnet 1  
Tilt ball switch 1  
Transistor pn2222 1  
TIP120 1  
Relay 1  
RGB led 1  
Dc toy motor 1  
Diode 1n4001 1  
Lm7805 1  
Power connector 1  
9v snap power connector 1

10uf capacitor 1  
47uf 1  
100uf 1  
1000uf Cap 1  
1500uf cap 6.3v 1  
10k Resistors 1  
1k Resistors 1  
330 ohm Resistors 1

# About parts

Symmetric vs Asymmetric

Polarized

Physics and chemistry in a tiny package

Explain Data Sheets

# What is electricity?

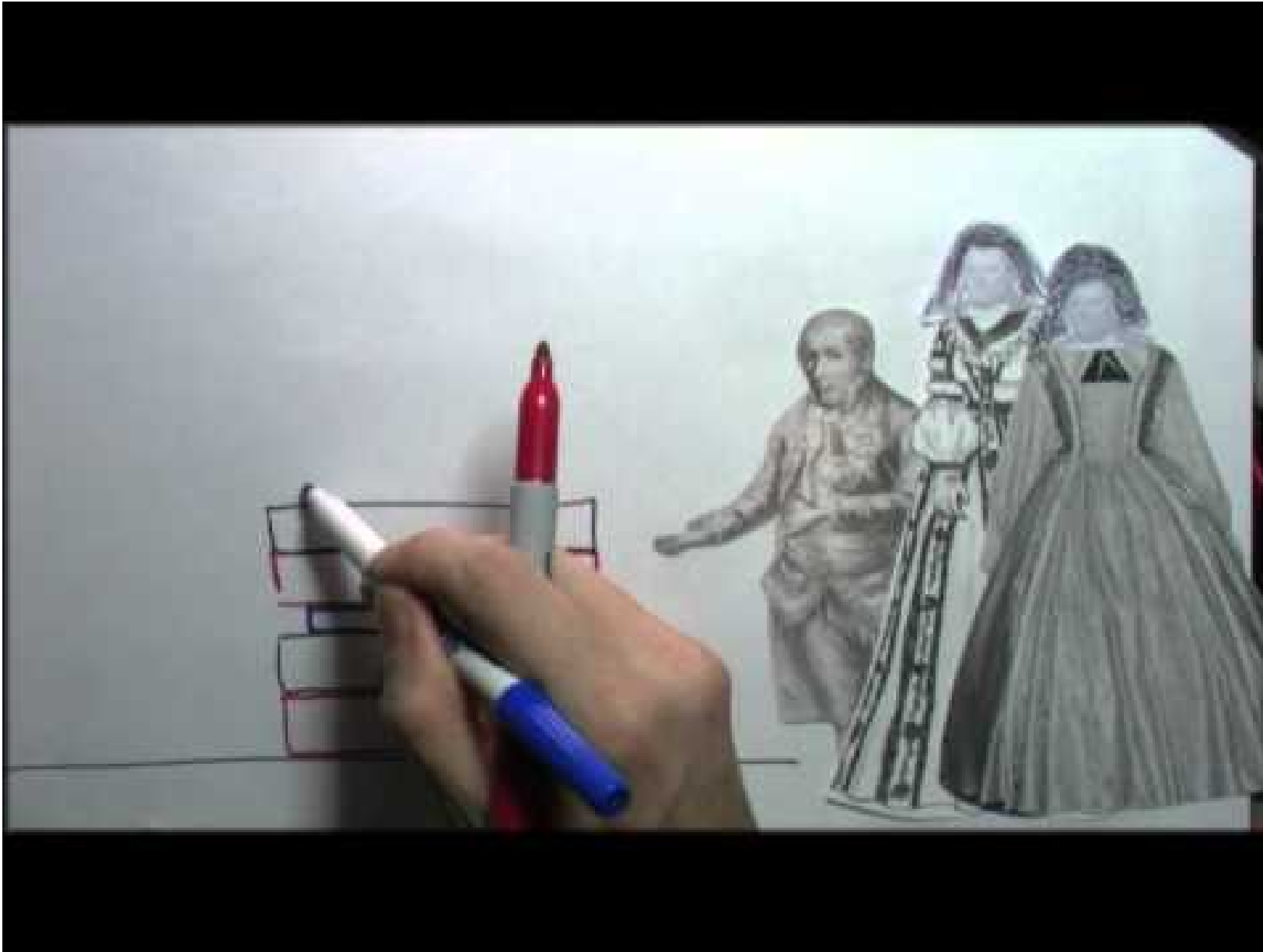
What kinds are there?

What can it do?

What are the dangers?

# Batteries as a power source

What kinds of batteries are there?



# What is a circuit?

Combination of electronic parts, wires connected between power sources. It's like a physical program. It's also like setting up dominoes in sequence.

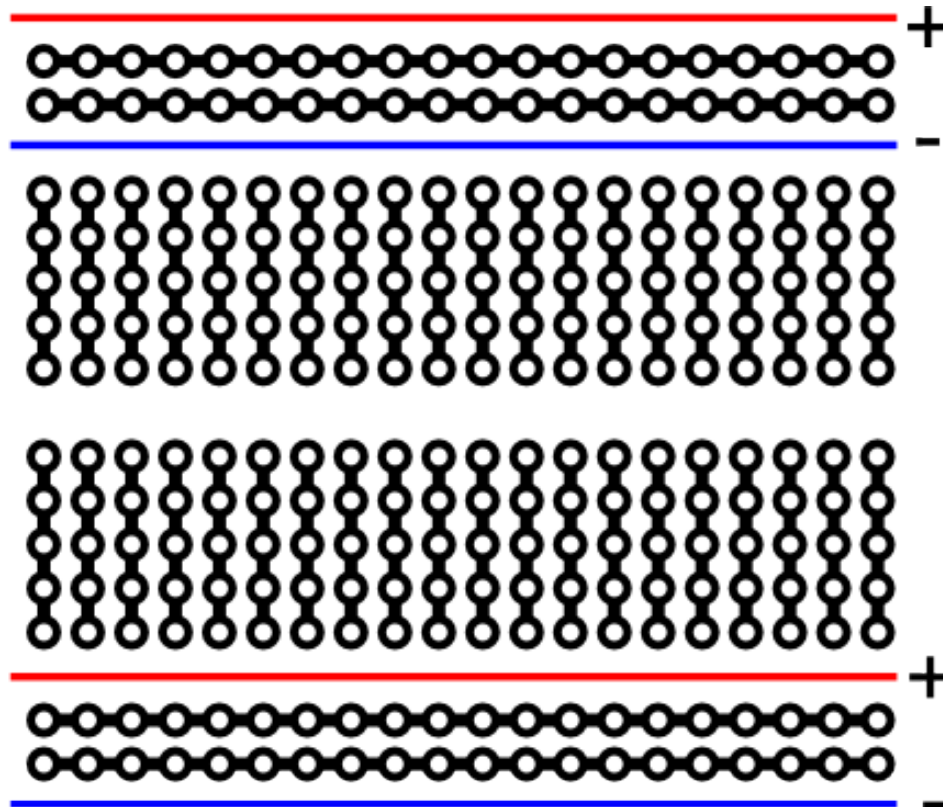


# What is a breadboard?

What are they good for?

Creating, organizing, and prototyping a circuit.

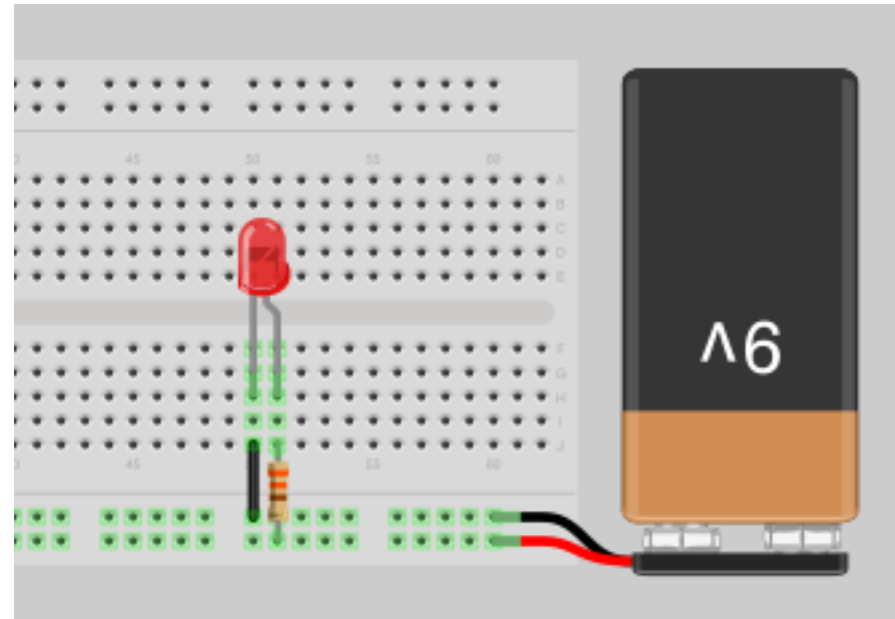
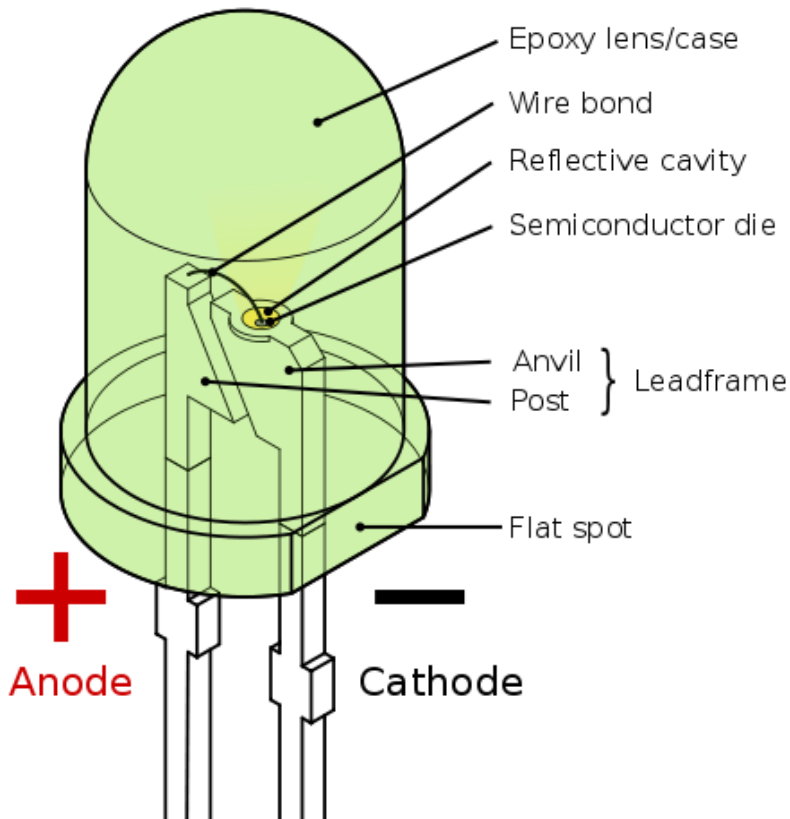
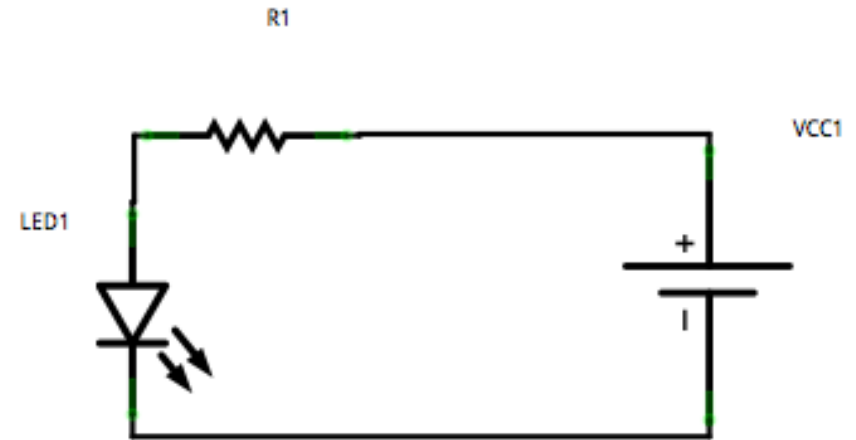
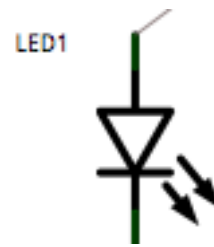
Literally started out as a bread board with nails.



# What are LEDs?

Light Emitting Diodes

Diode Symbol + Arrows for light  
Points to ground



# Hello World for a Circuit

Light and LED

Parts:

Battery

Resistor

LED

Why:

Power Source

An LED will light up when enough voltage is supplied but can also burn out if too much is allowed to pass through. The resistor will limit the voltage to prevent damage.

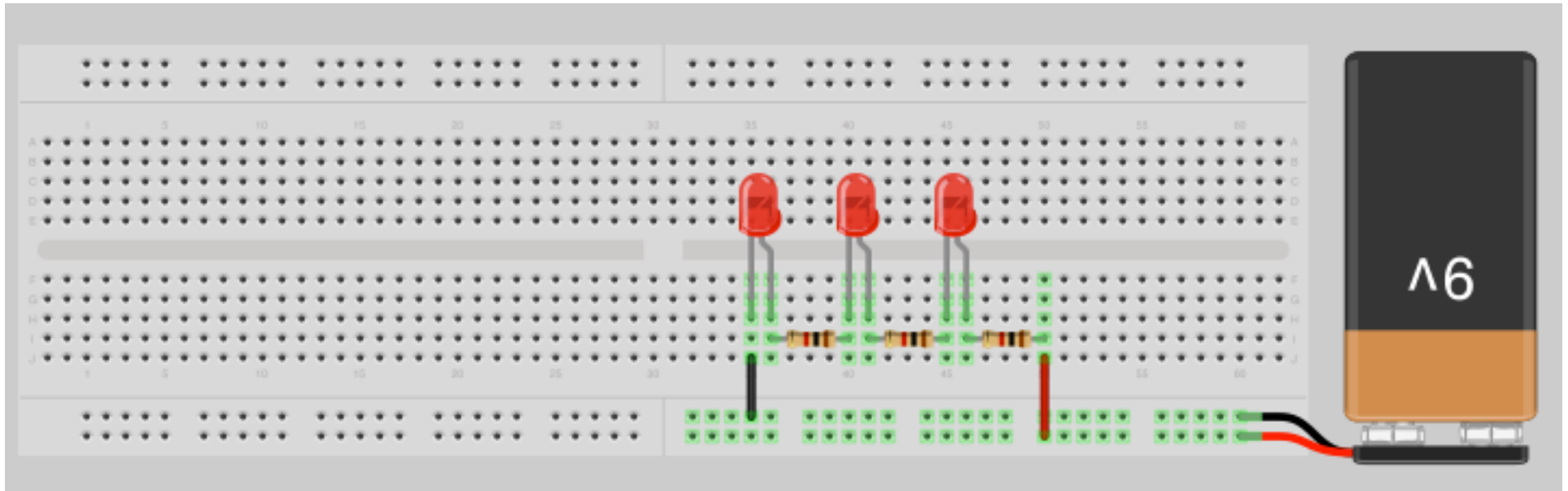
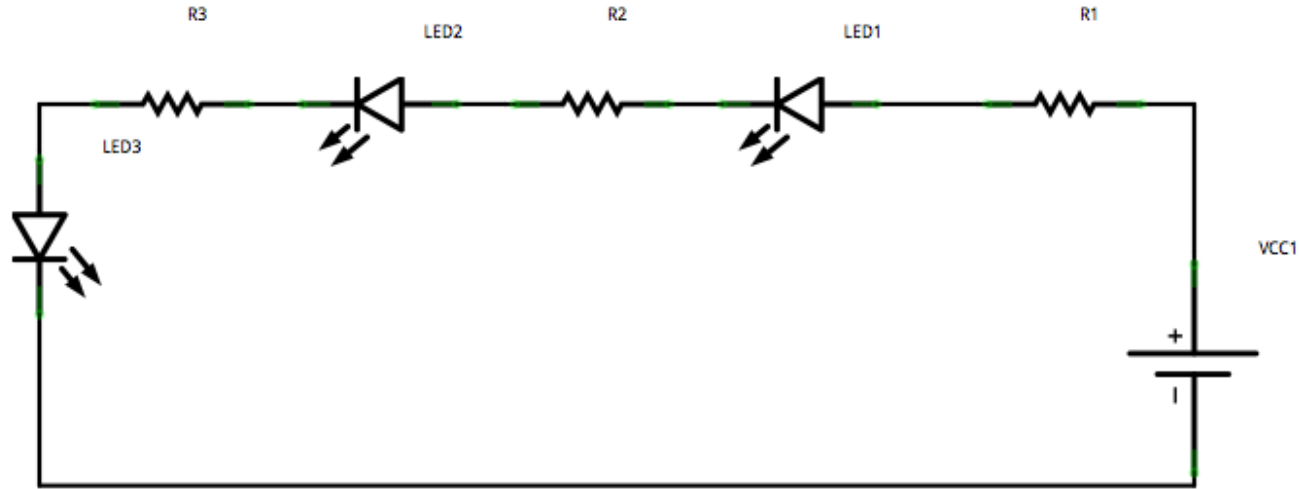
Do:

Connect Battery, Resistor, LED

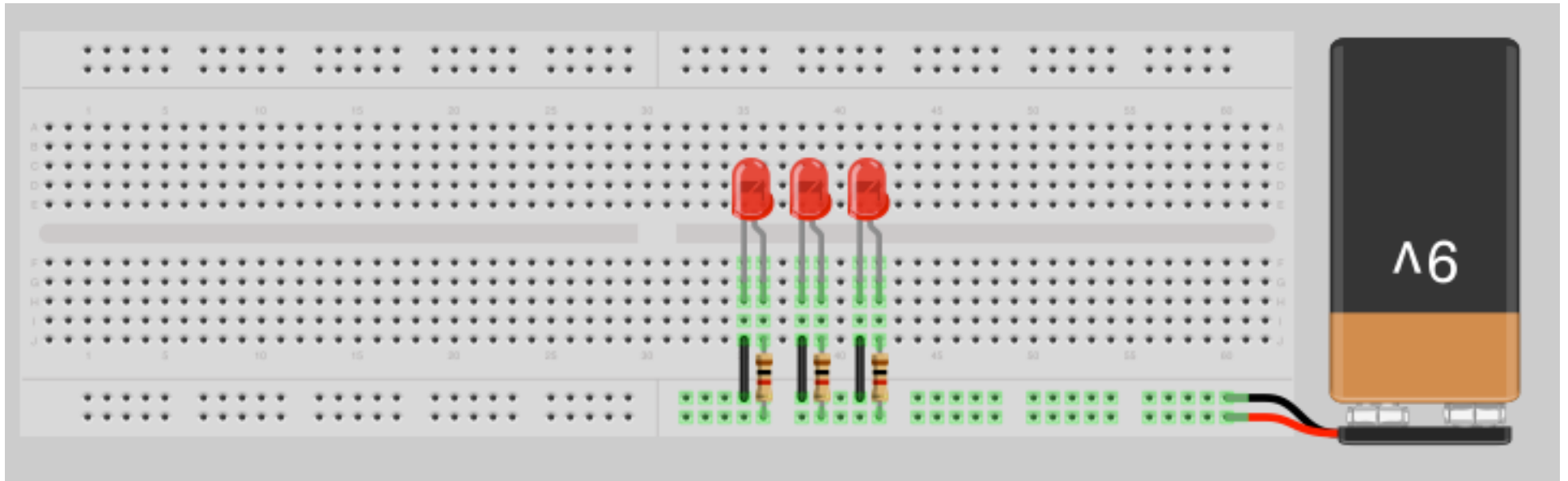
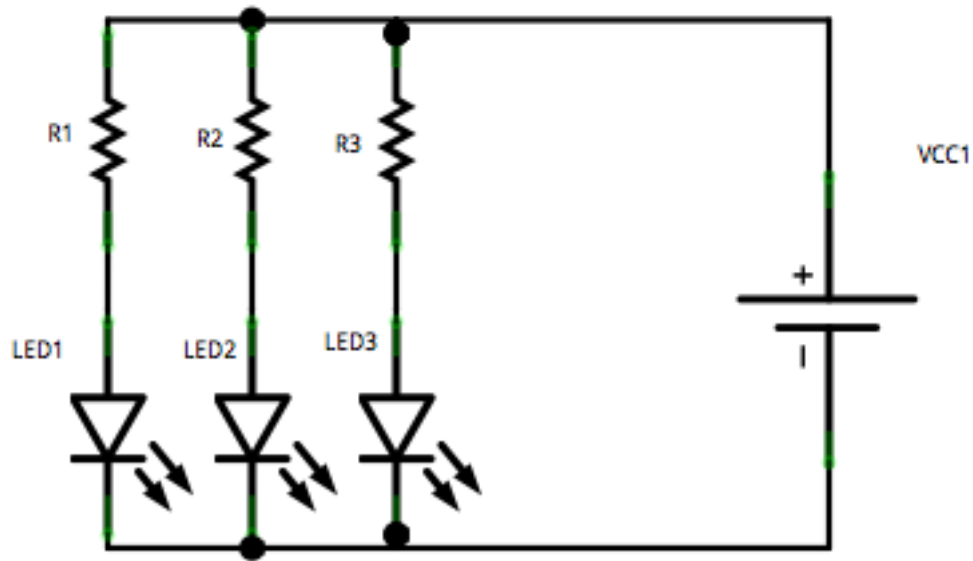
# LED Circuit

1 LED Plus resistor  
Why have a resistor?  
Current, limiting.

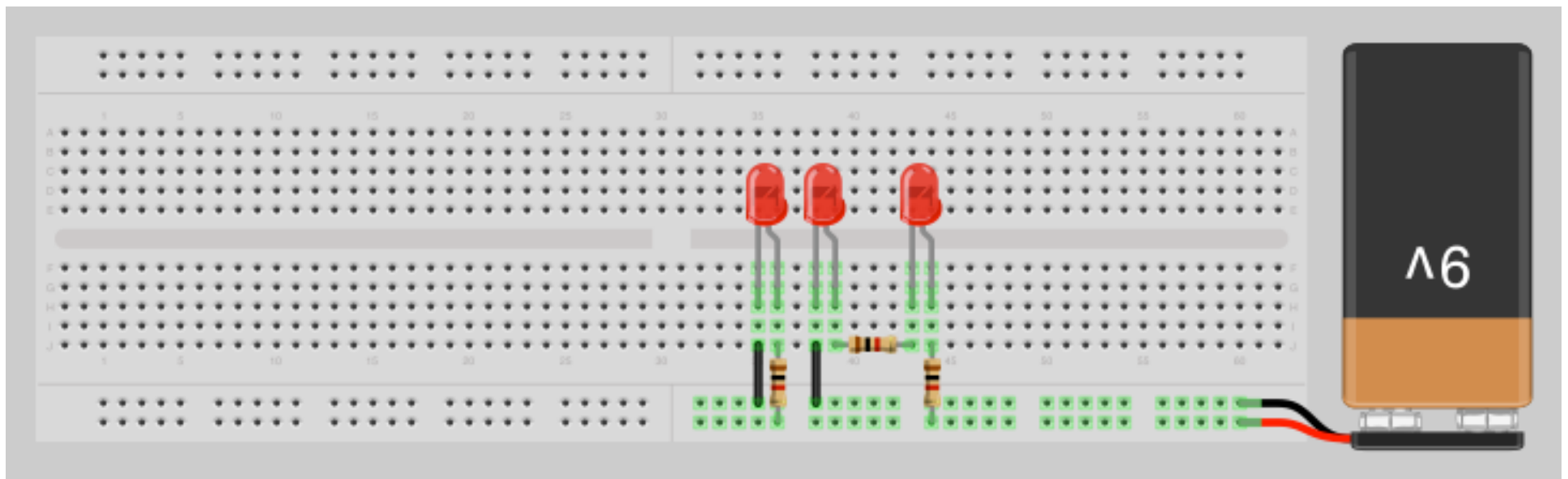
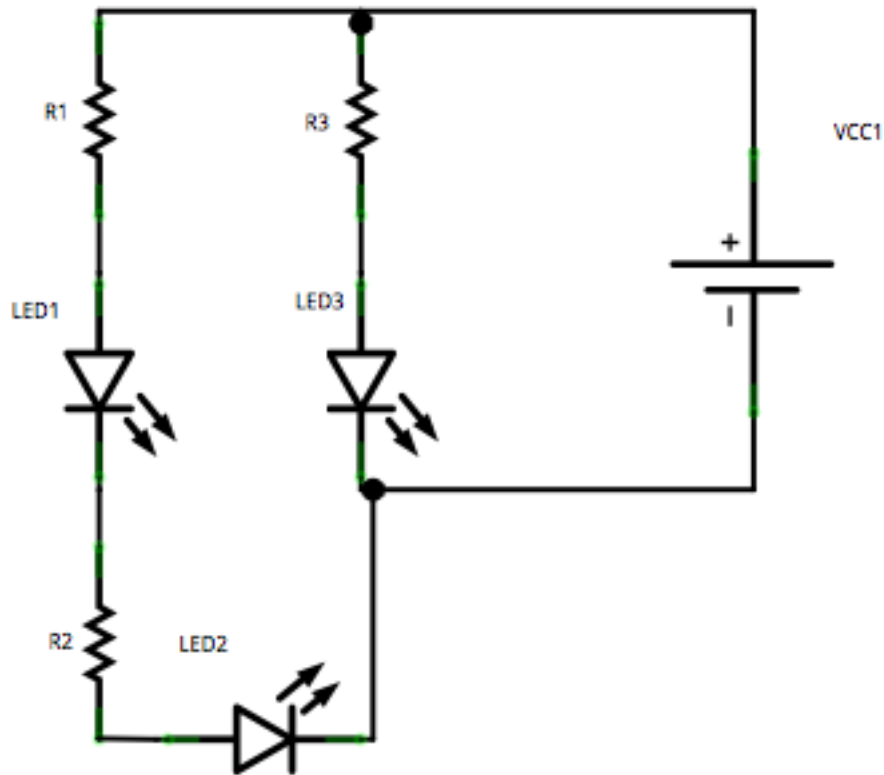
# Series circuit example



# Parallel Circuit example



# Parallel and Series Circuit Example



# Fundamental Parts

Resistor

Capacitor

Wire

Diodes

Light Emitting Diodes (LED)

Battery

Transistors

Motors

They each have a physical property that interacts with electricity. When put in combination various actions occur.



# What are resistors?



Resistors provide a specific amount of resistance to a path in a circuit or wire. Ohm's law is used to calculate the properties related to resistance.

Ohm's Law:  $I = V/R$

$I$  = Current measured in Amps

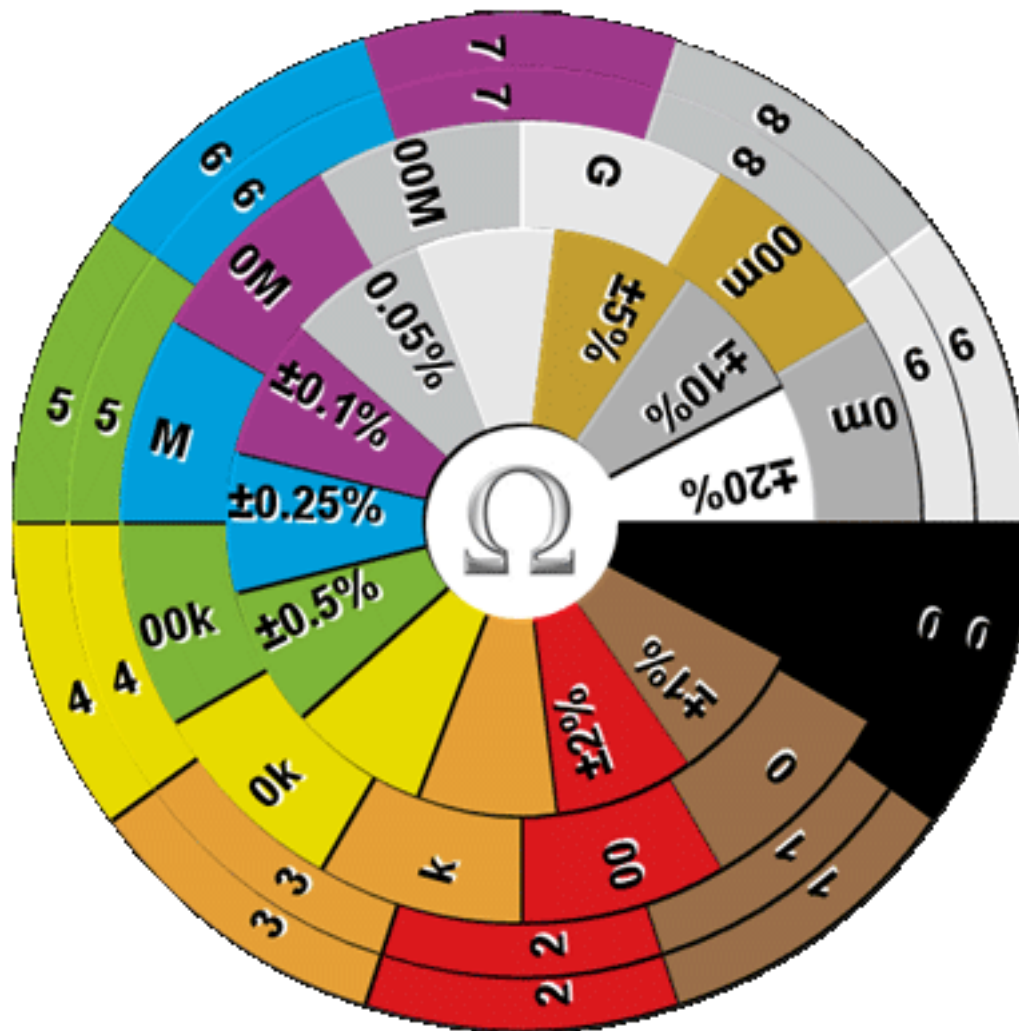
$V$  = Voltage measured in Volts

$R$  = Resistance measured in Ohms

Resistors are color coded.

# Resistor Color Code

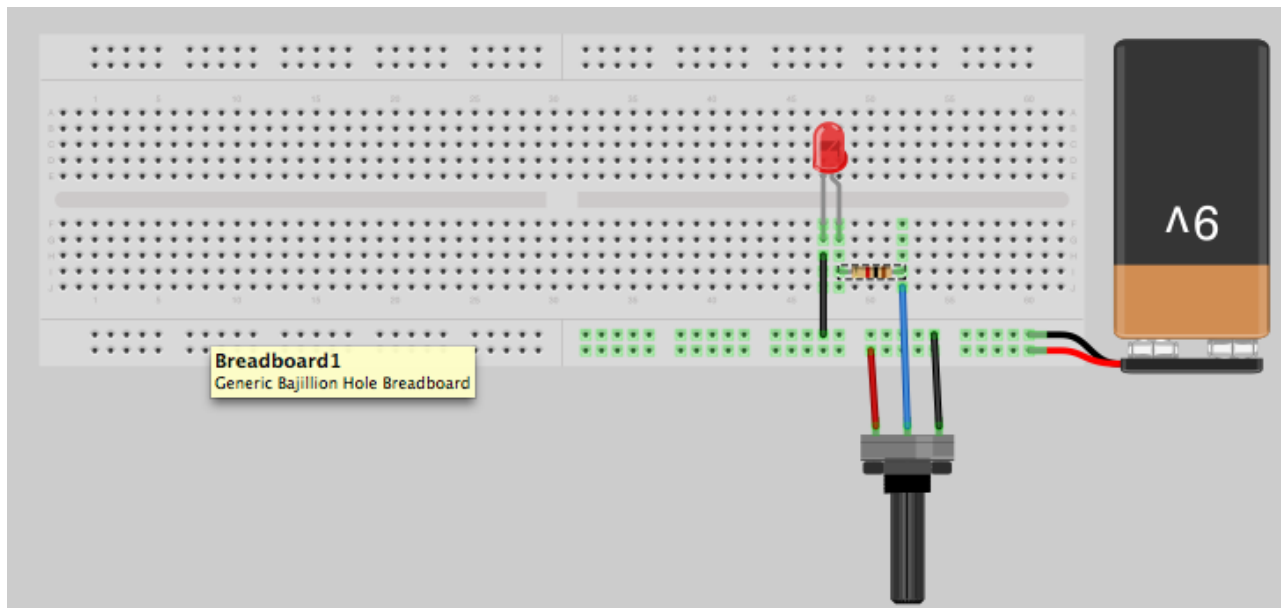
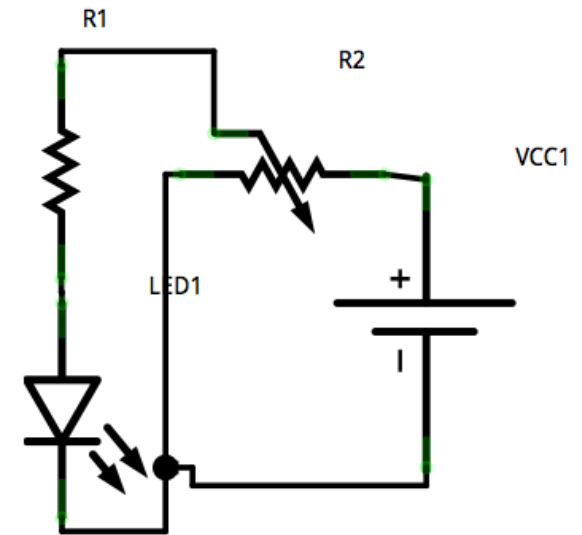
[Resistor Color Code Wheel Calculator](#)



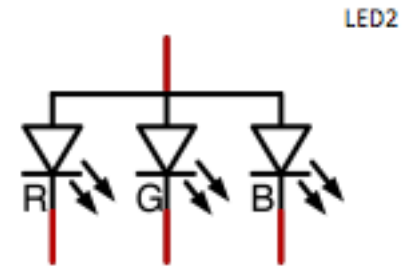
# Variable resistor: The potentiometer

Voltage dividers

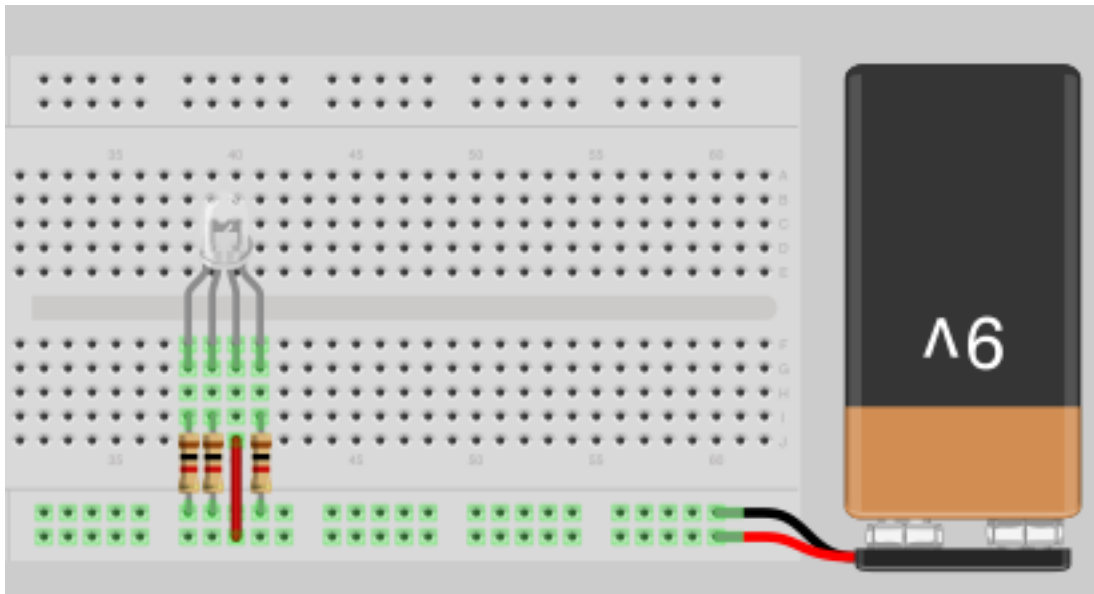
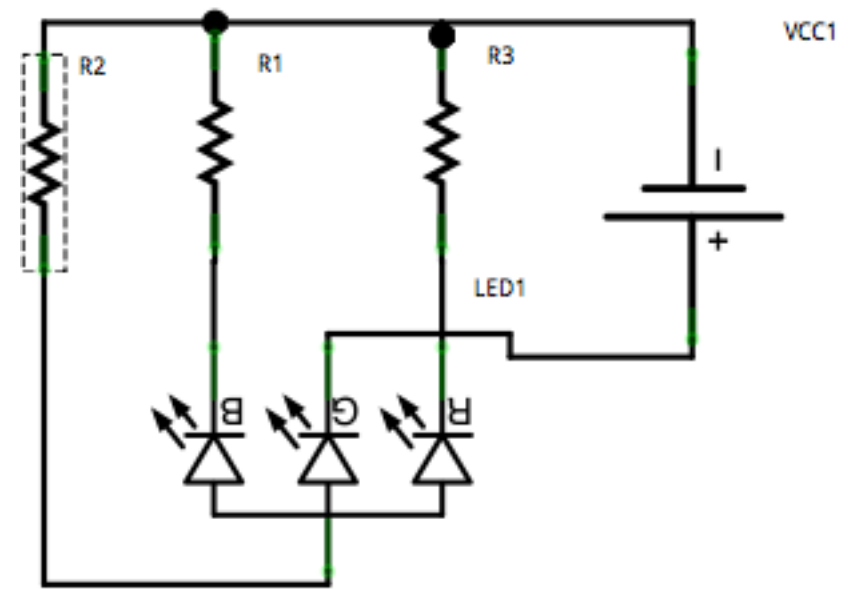
Try out the different pots.



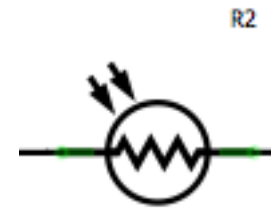
# RGB LED



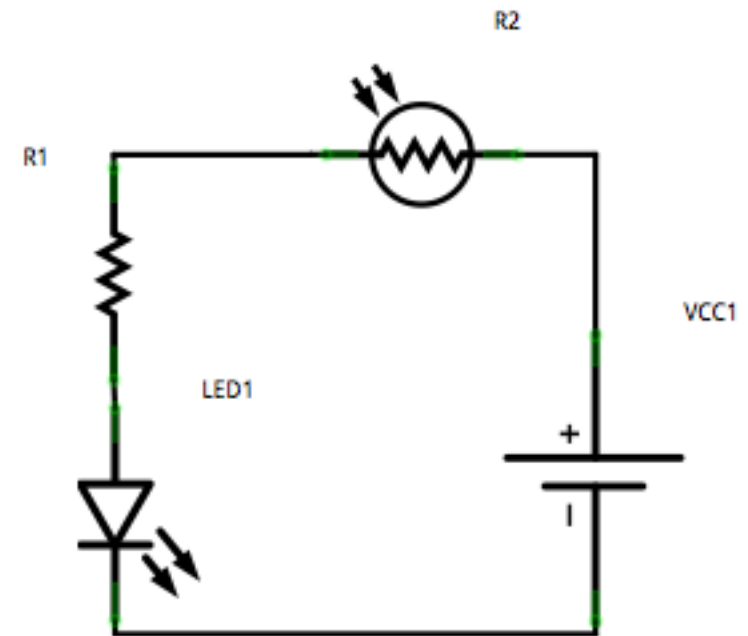
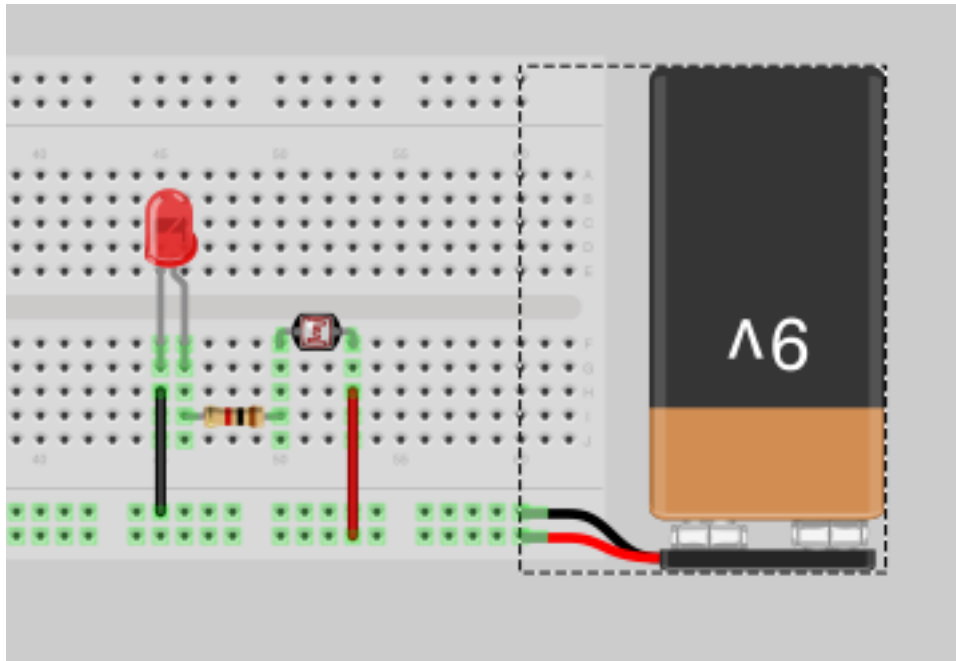
Try resistors out in various combination to make different colors. Experiment by adding potentiometers to the leads.



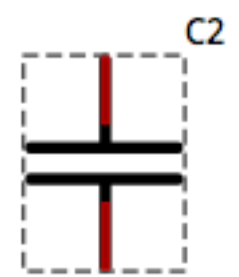
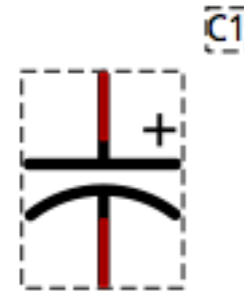
# LED and Photoresistor



Photoresistors change their resistance by the amount of light detected.



# What are capacitors?



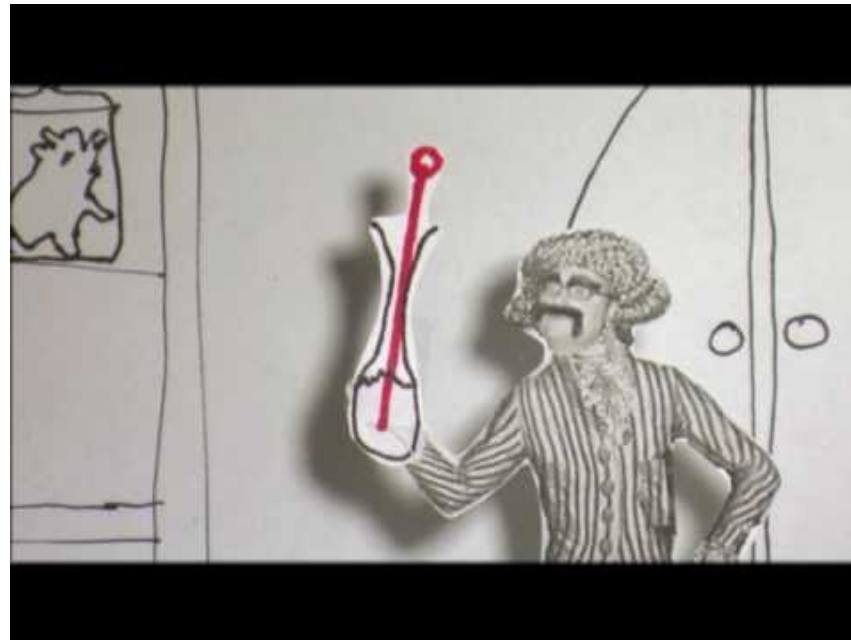
Capacitor is two separated charges.

Known charge up time.

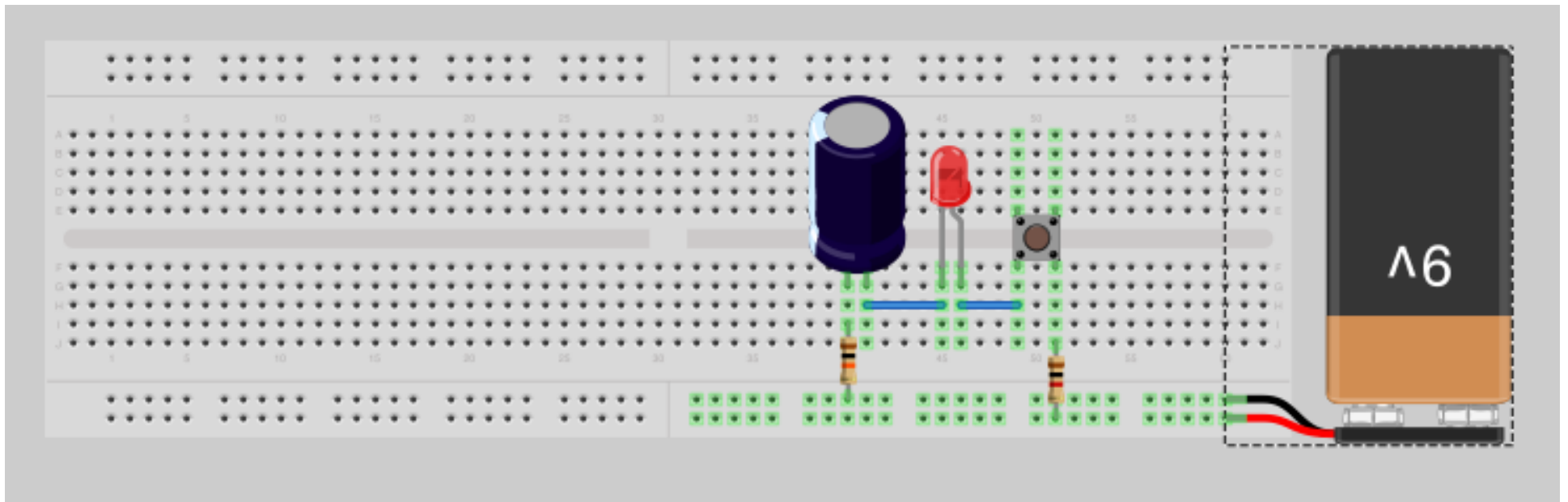
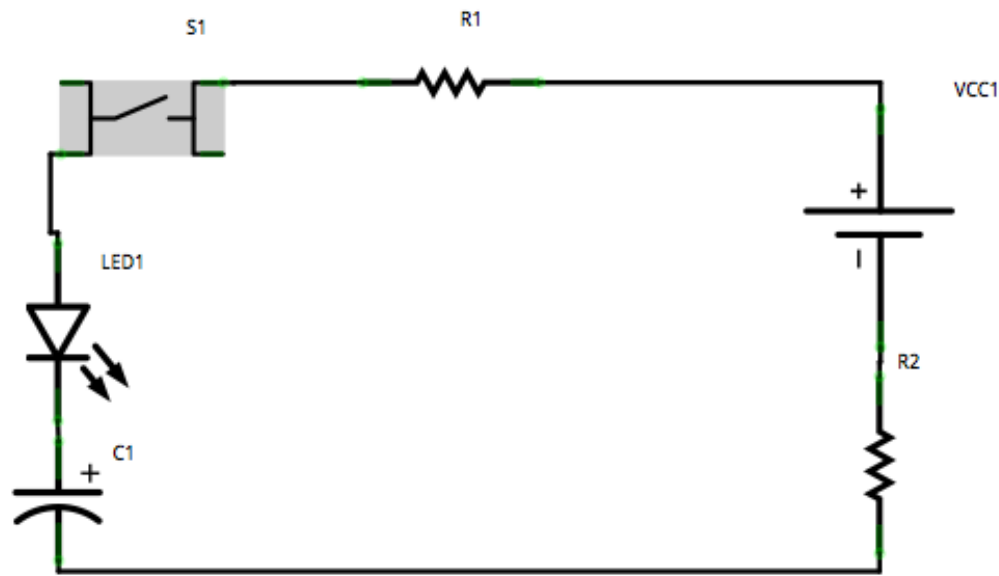
Known discharge time.

Two major kinds

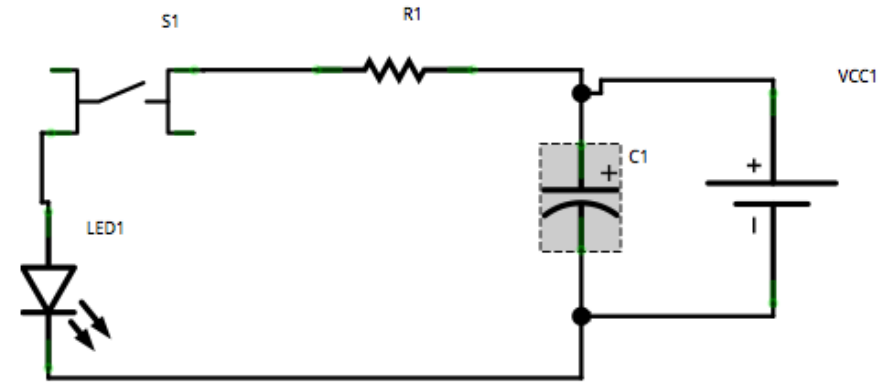
- Electrolytic, asymmetric, bipolar
- Ceramic, symmetric



# Capacitors in series

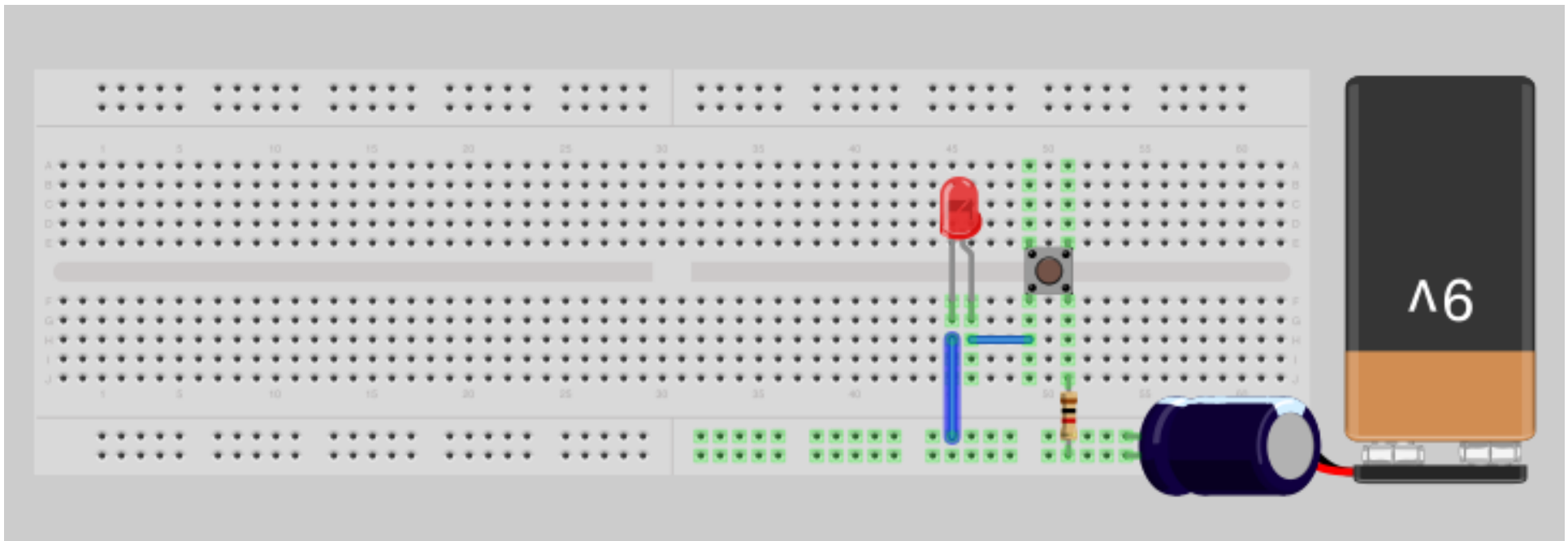


# Capacitors in Parallel



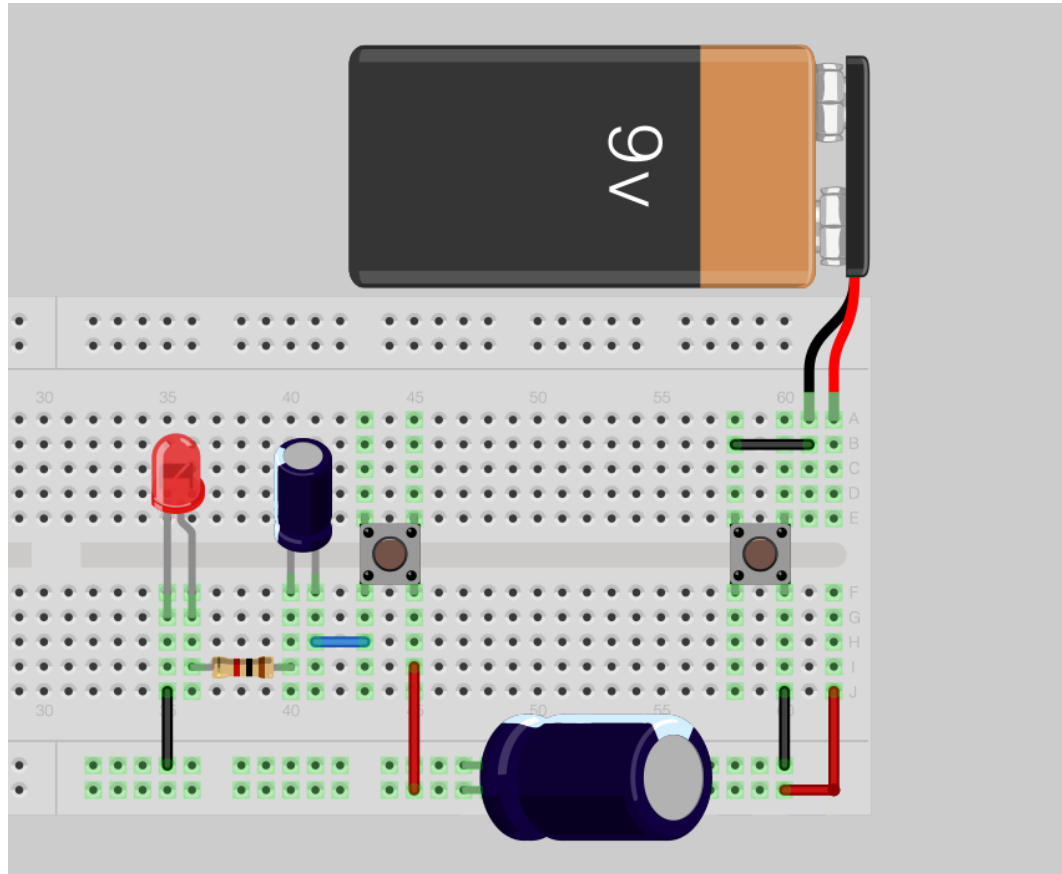
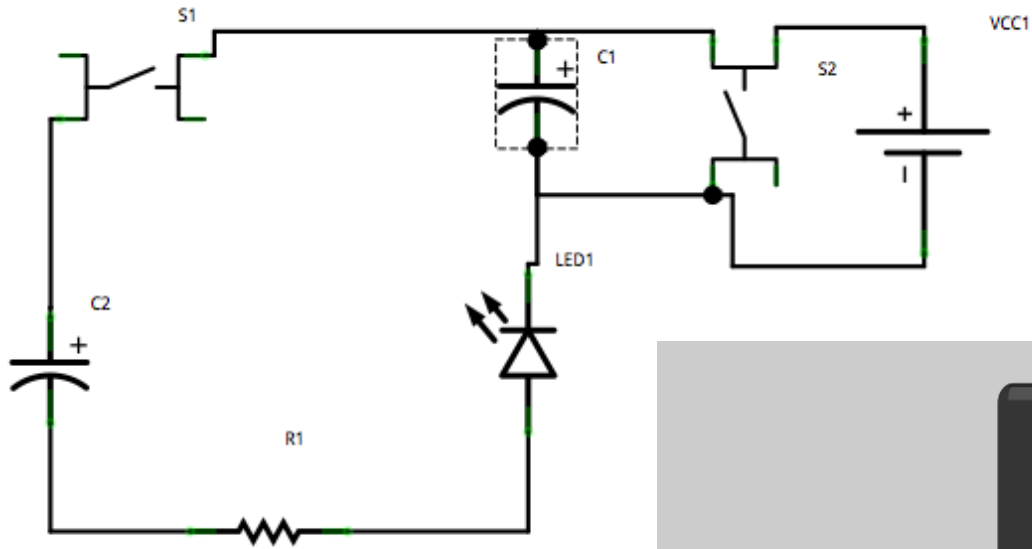
They can provide energy, however briefly.  
They can smooth out a signal.

Attach the battery briefly to fill the capacitor.

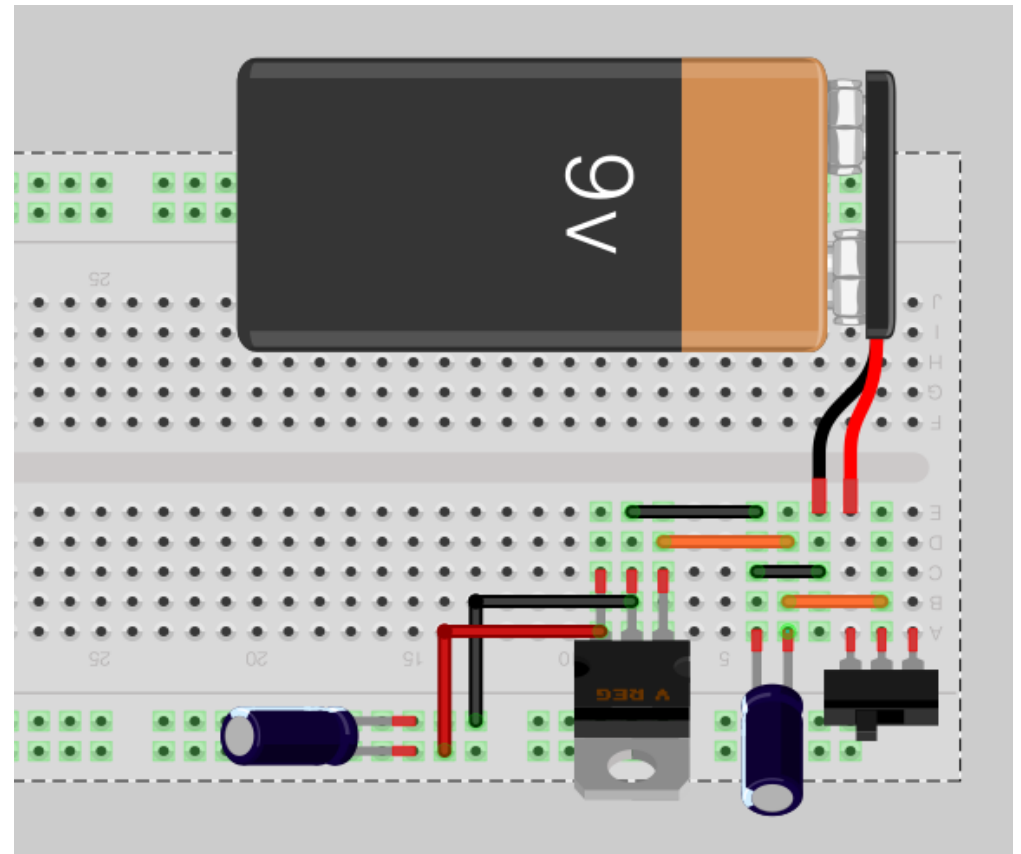
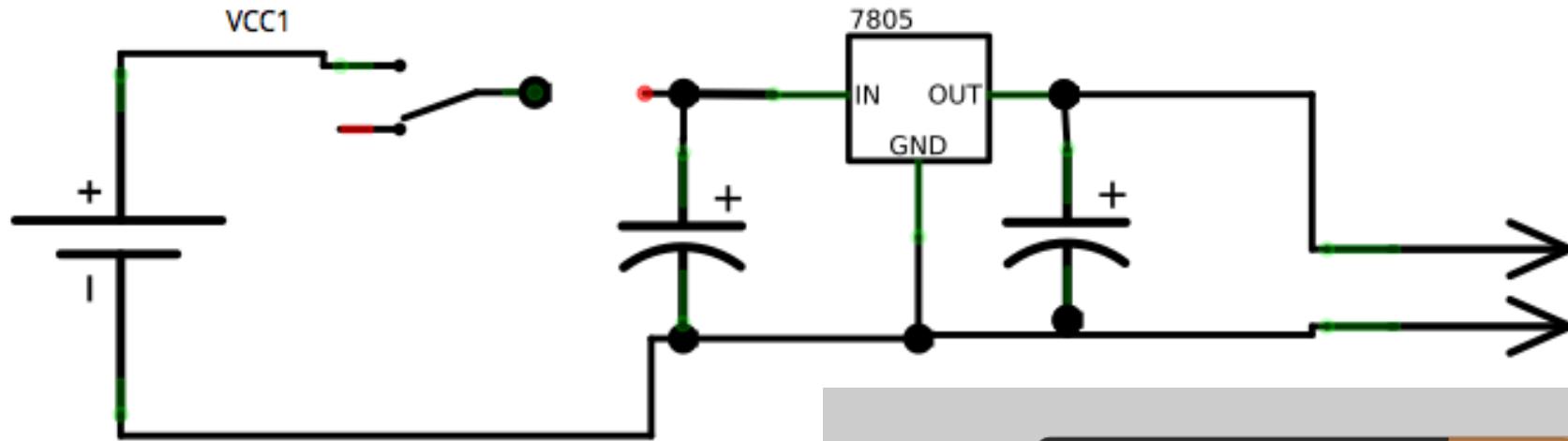




# Capacitors in series and parallel



# Make a voltage regulator



# Turn things on and off with a:

Photoresistor

Hall Effect Sensor

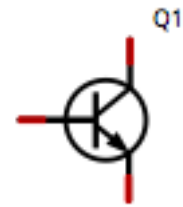
Relay

Transistor

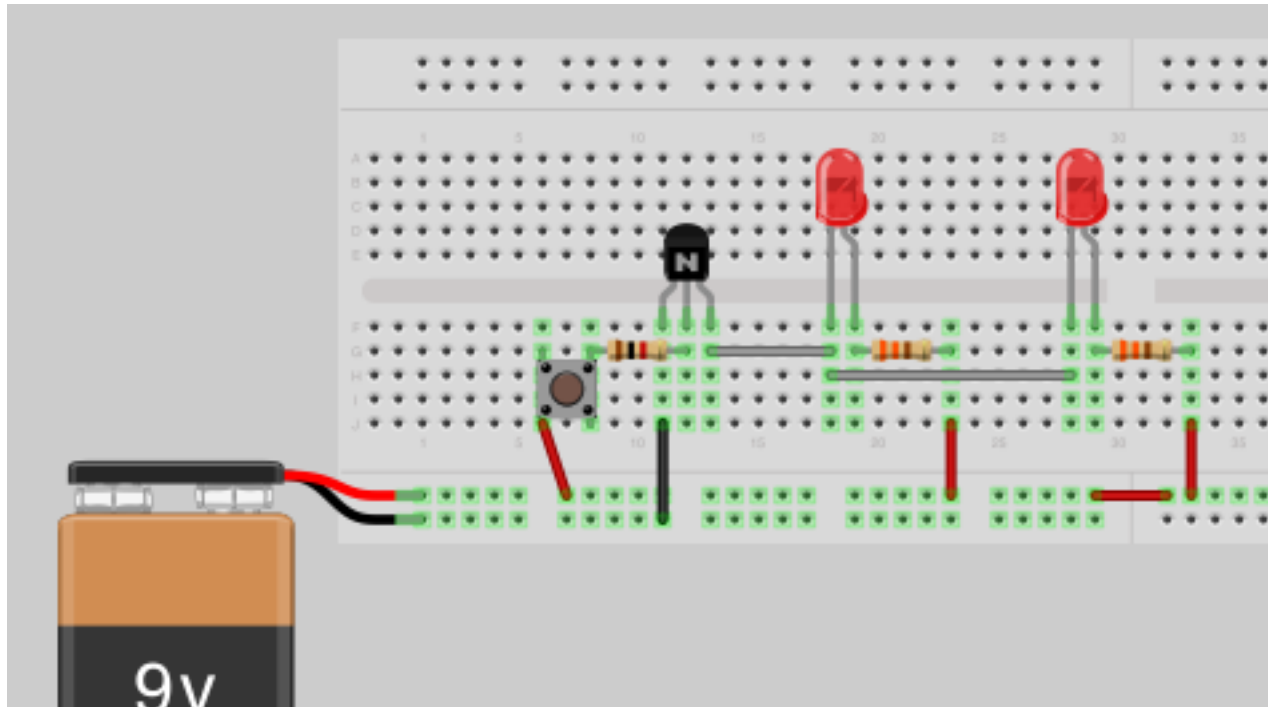
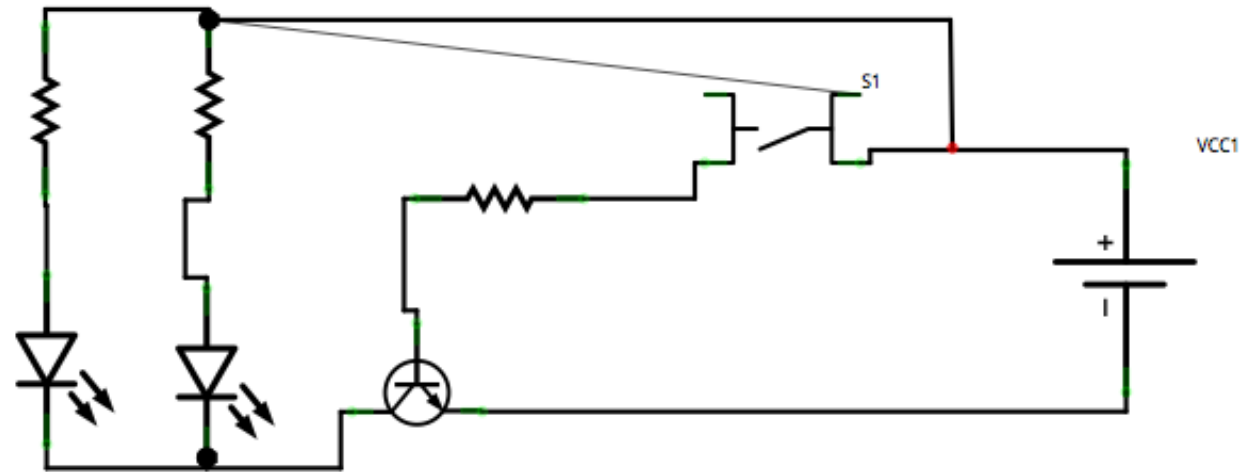
Button

Switch

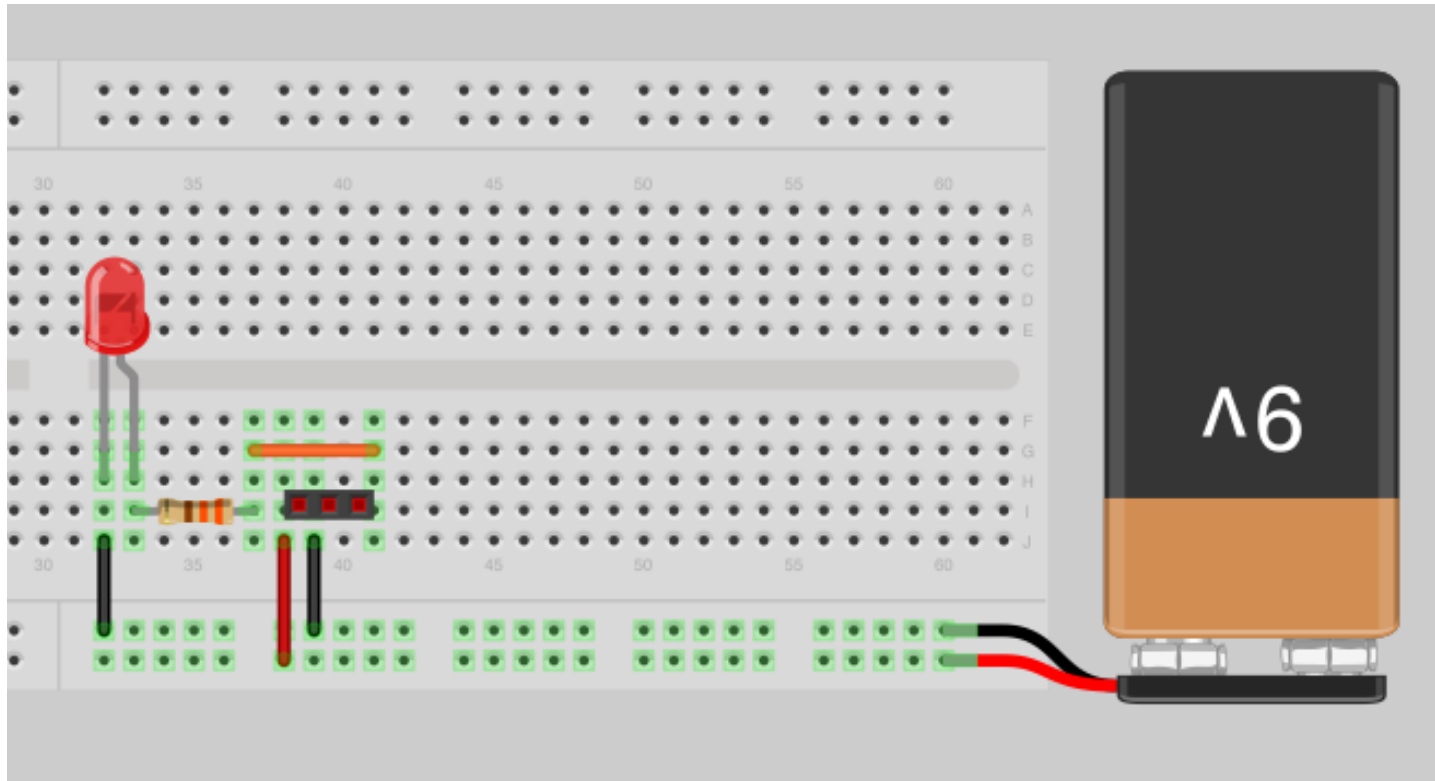
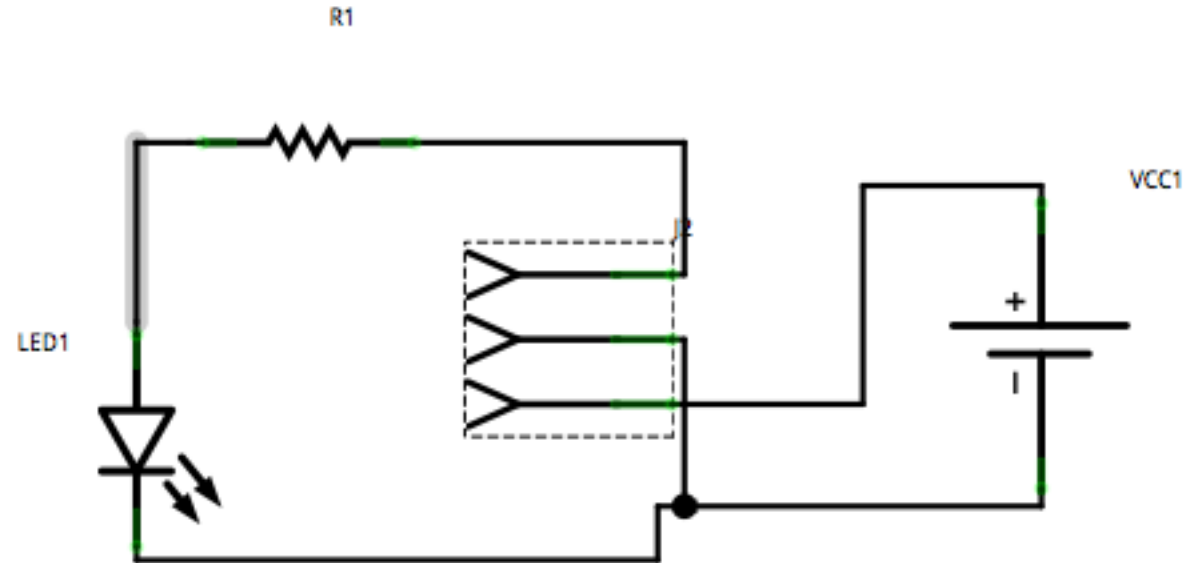
# Transistors



## NPN Transistor

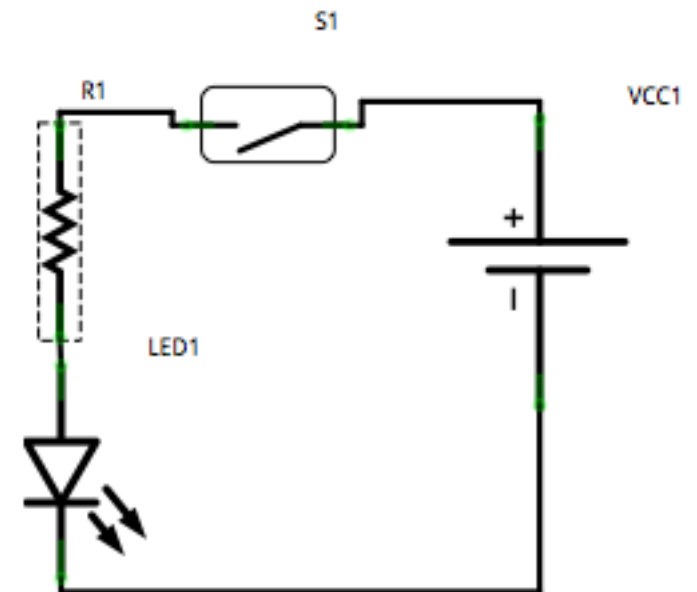
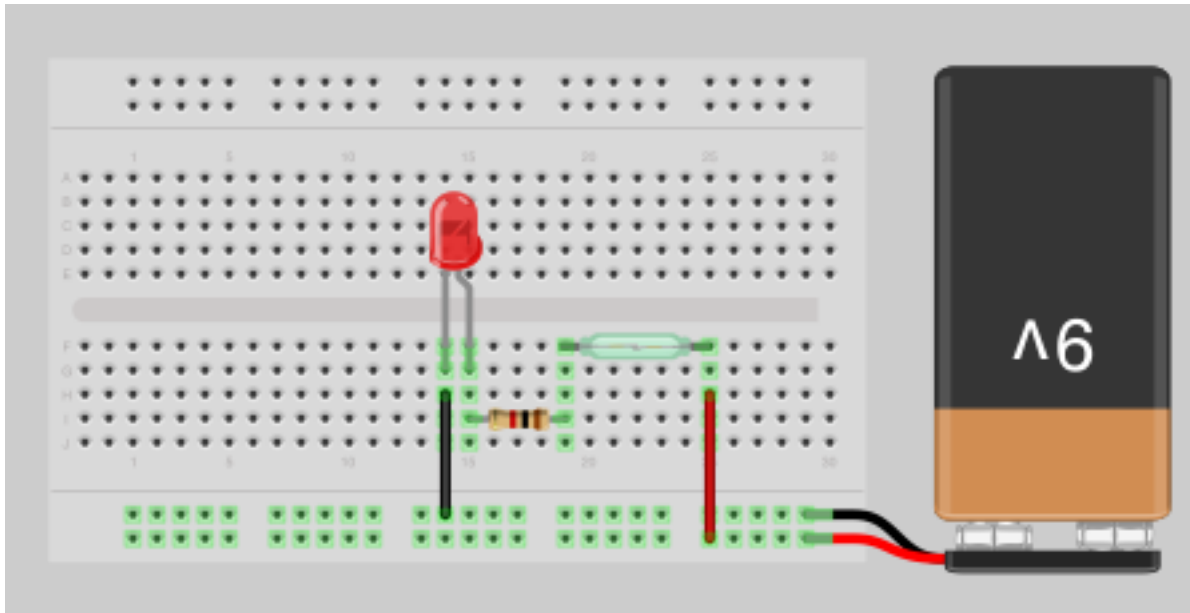


# Hall Effect Sensor



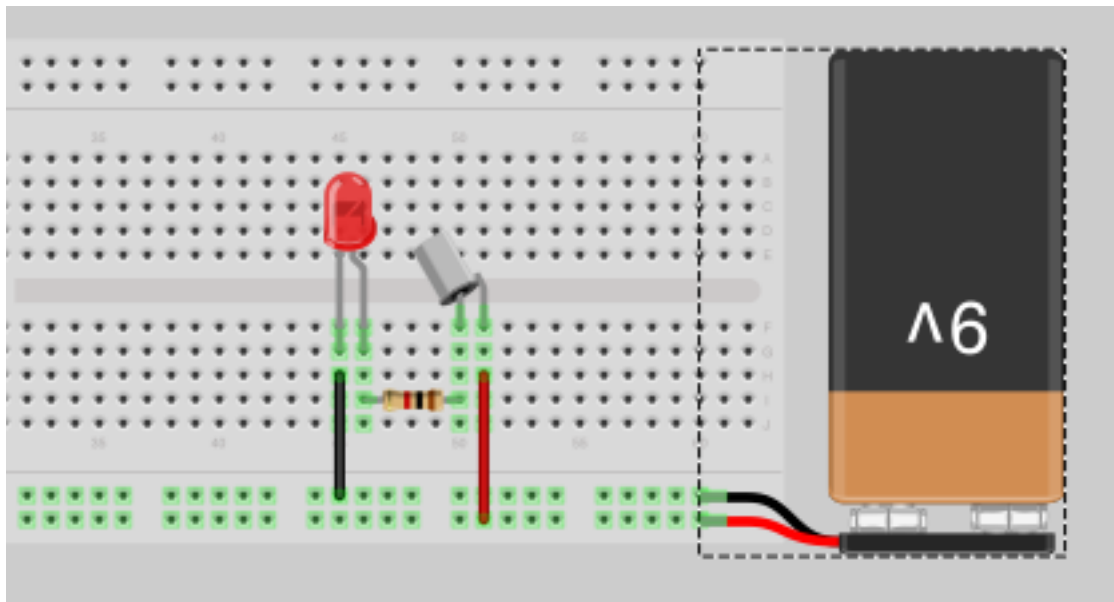
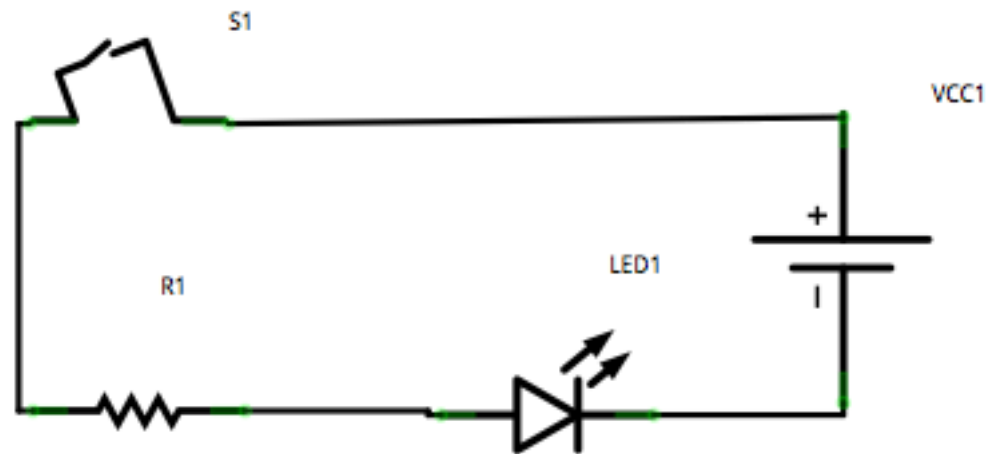
# Reed Switch Example

A reed switch is closed when a magnet is in close proximity. It is symmetric so it can be placed either direction.



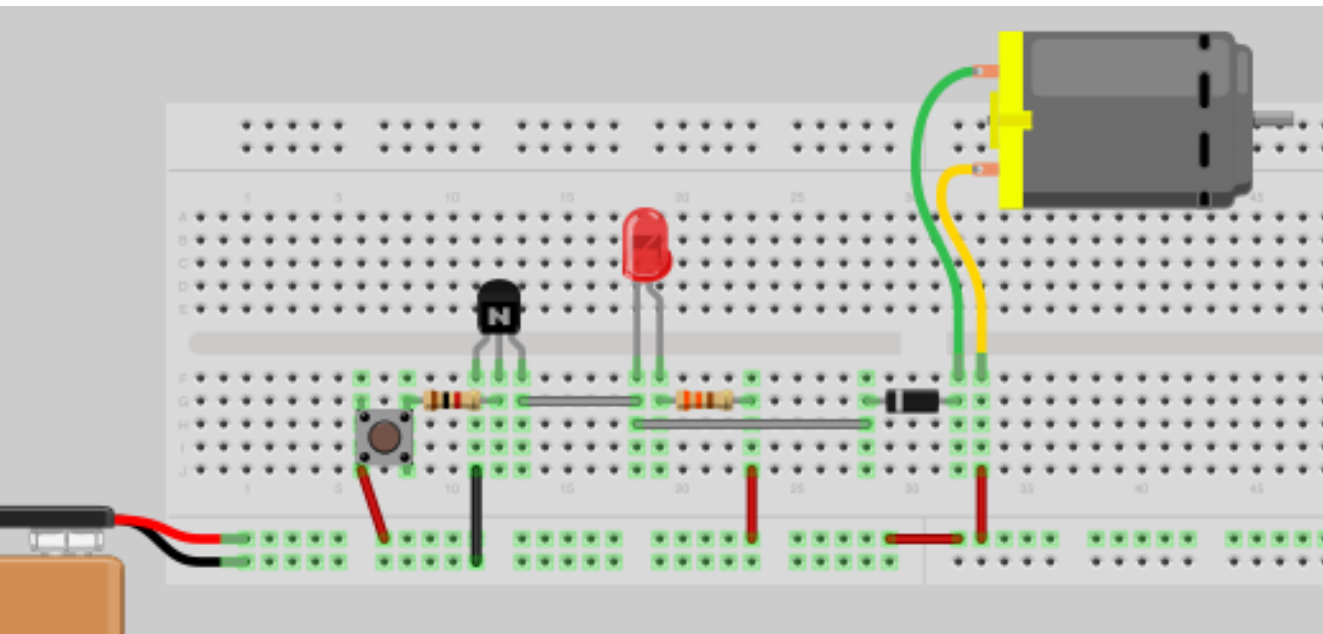
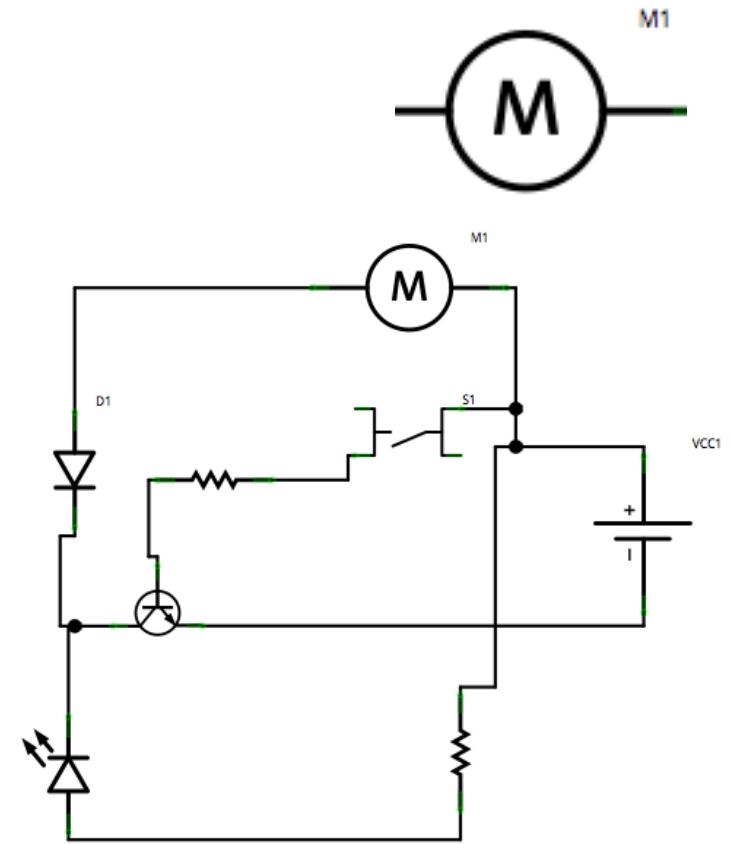
# Tilt ball switch

Emergency on/off if project tips over.



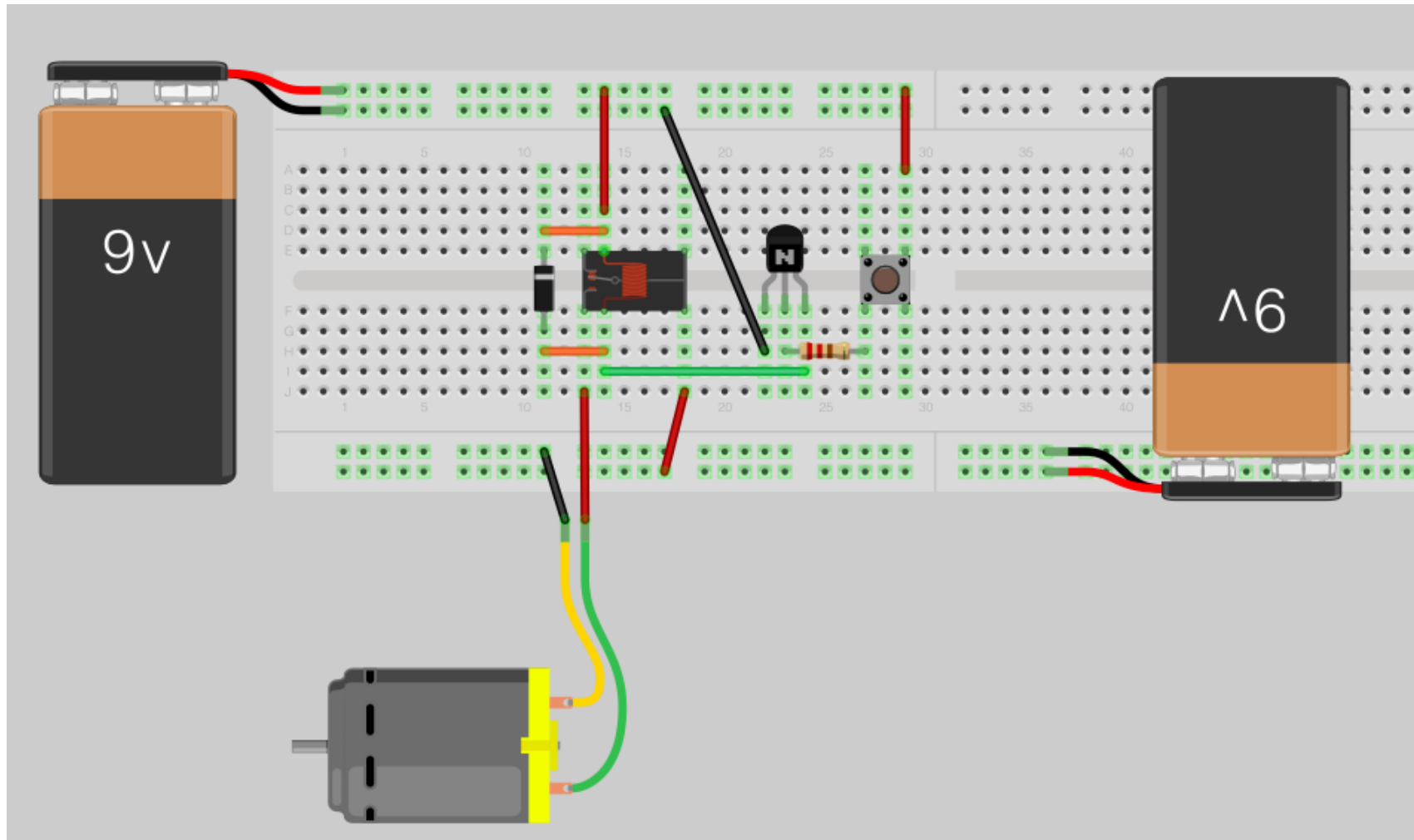
# Motors

Try changing the direction of the diode.  
What happens?





# Relay



# Simulate a traffic light

Let's figure it out