creativity & computation lab

week 6 || electrifying!

review

WHERE WE HAVE BEEN

What we have done:

Arrays + OOP

Libraries

GIT

agenda

WHERE WE ARE GOING

What's on for today:

Check out assignments from last class
What IS electricity?!
Voltage, resistance, and current
    Ohm's law of course
Breadboards
Field Trip!
Components
Circuits
    Parallel v. Series
Switches
Variable Resistors

last assignment

PRESENT

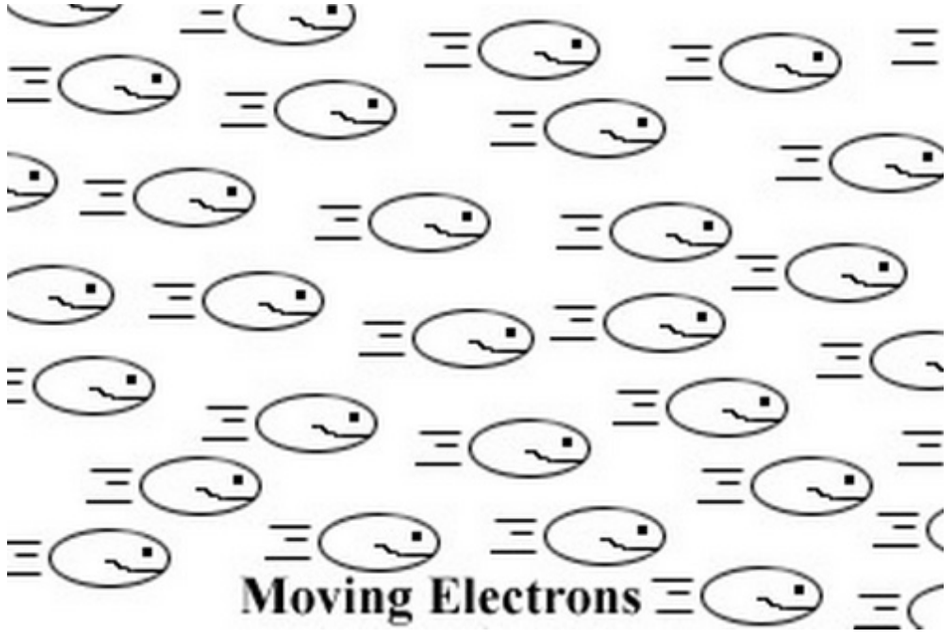
Let’s see them libraries!

electricity

SUPER HARD CONCEPT FOR ALL TO GRASP

What is electricity?

Electrical currents are created by a steam of moving electrons.

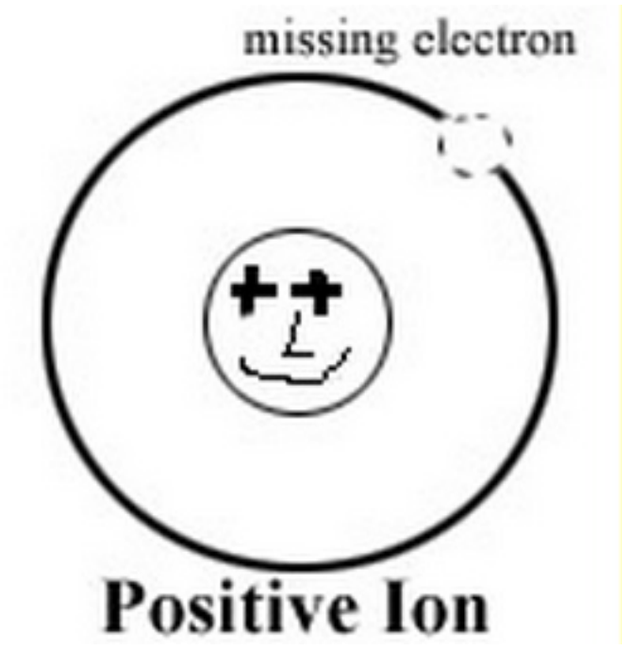


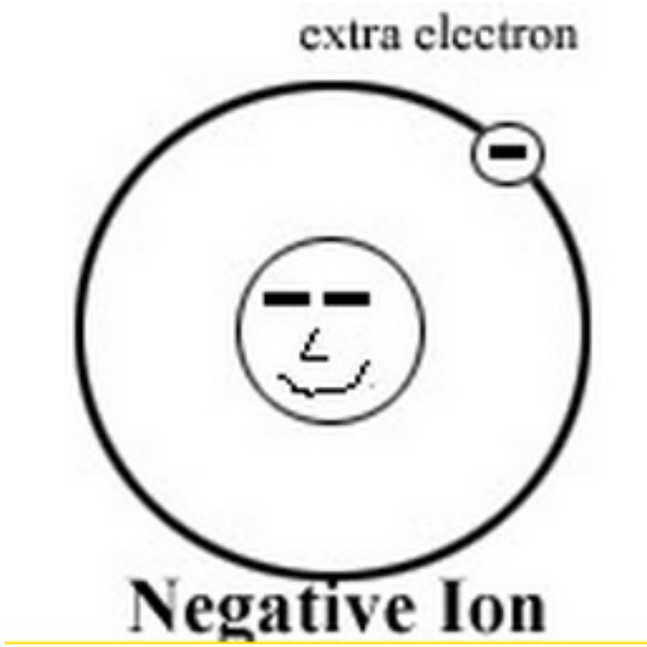
electricity

SUPER HARD CONCEPT FOR ALL TO GRASP

What is electricity?

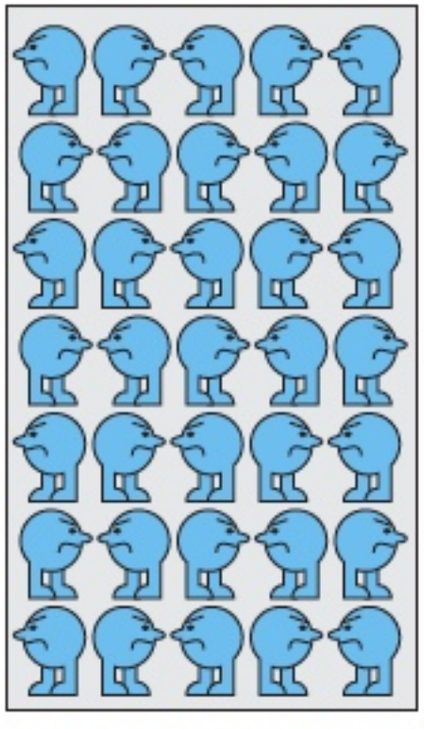
The electrons will move when they are attracted by positively charged ions. The electrons (negative charge) want to fill the voids left by missing electrons.





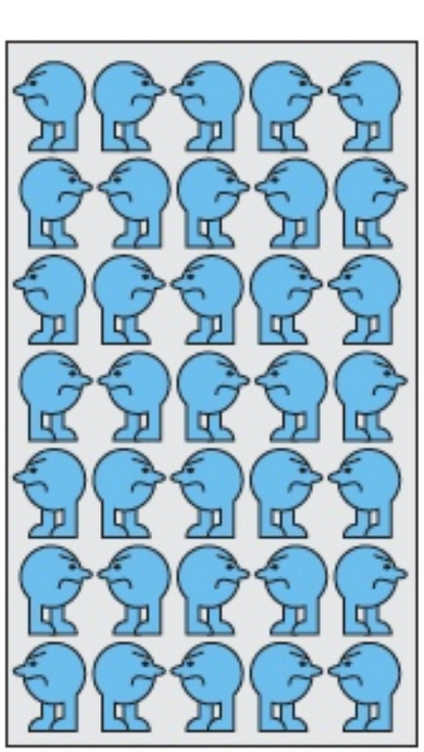
electricity

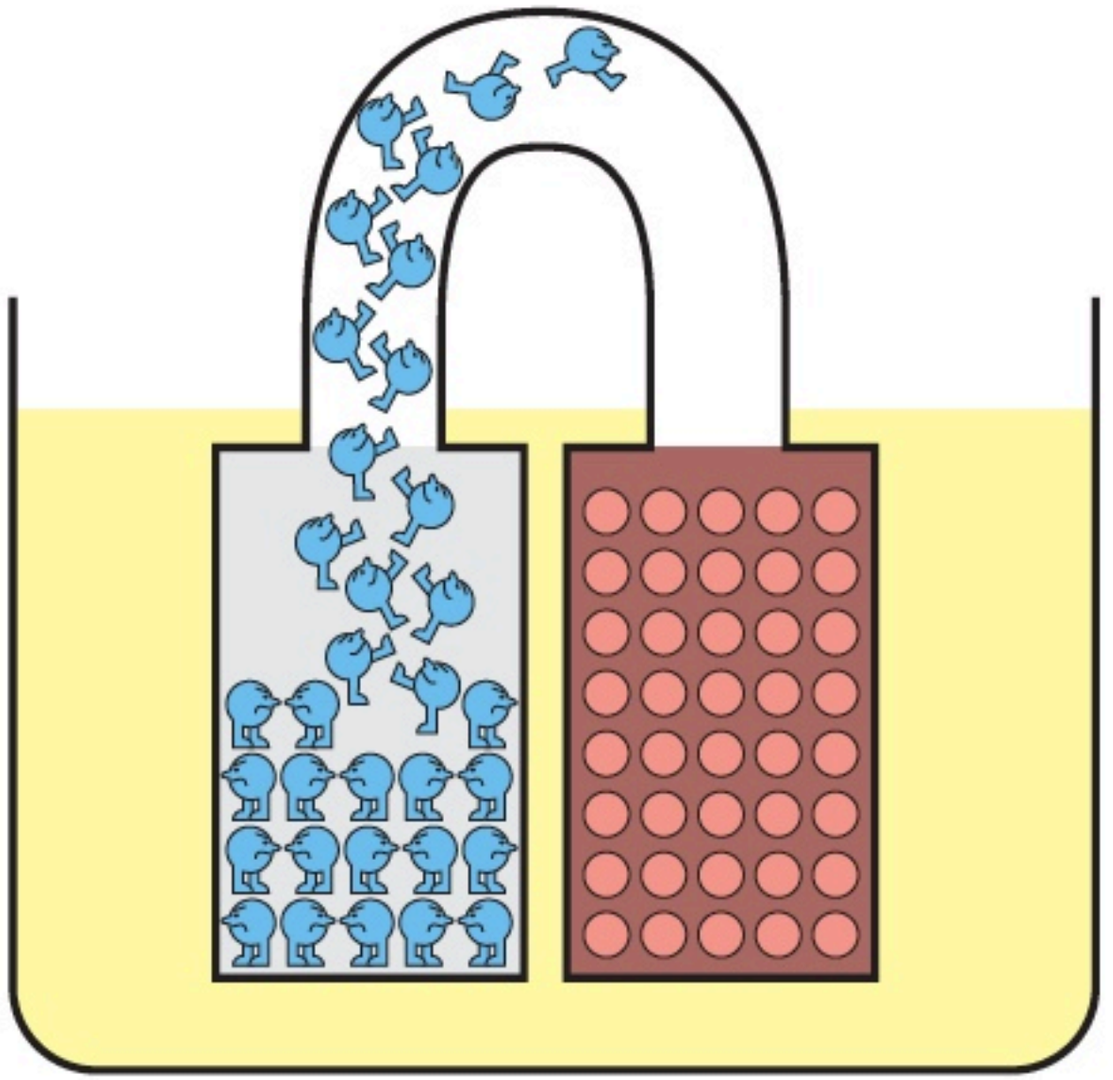
A CONCRETE EXAMPLE ON AN ATOMIC LEVEL



electricity

A CONCRETE EXAMPLE ON AN ATOMIC LEVEL





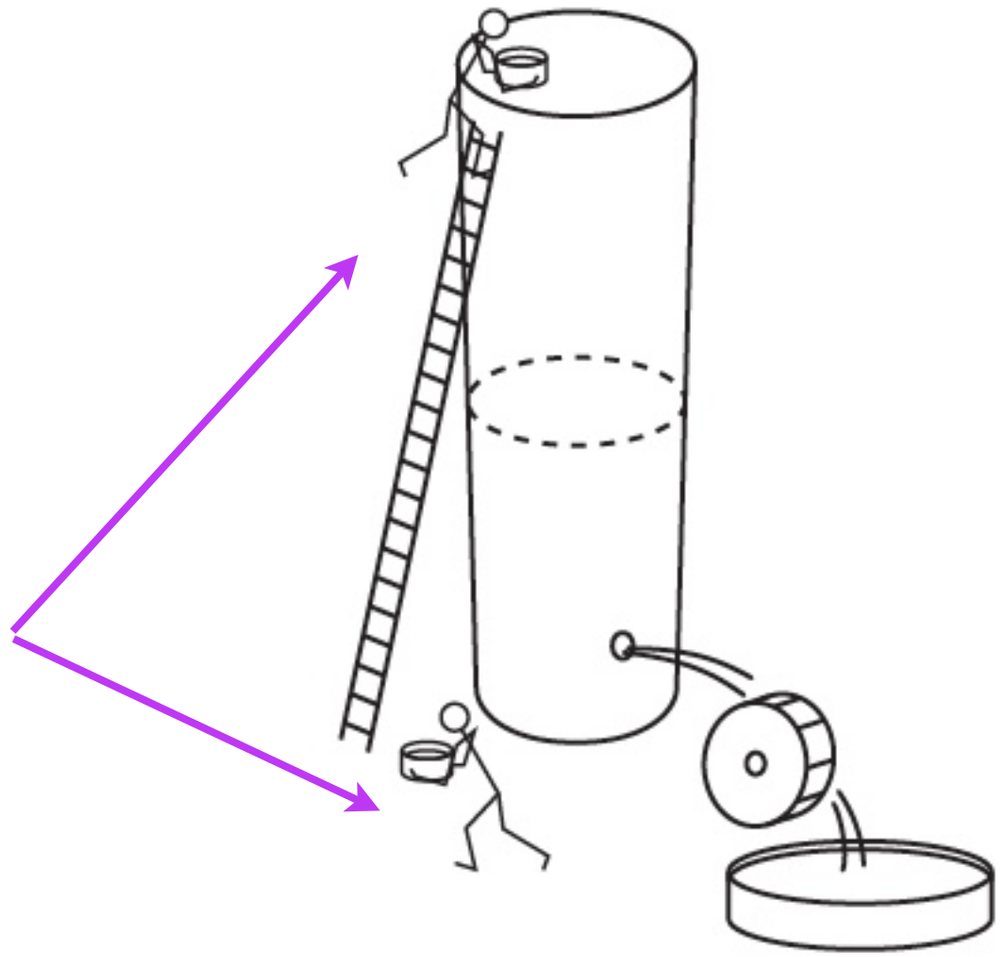
overview: the big three

VOLTAGE, RESISTANCE, AND CURRENT

Power

The work performed by an electrical current.
Measured in Watts.

The dudes with the ladder.



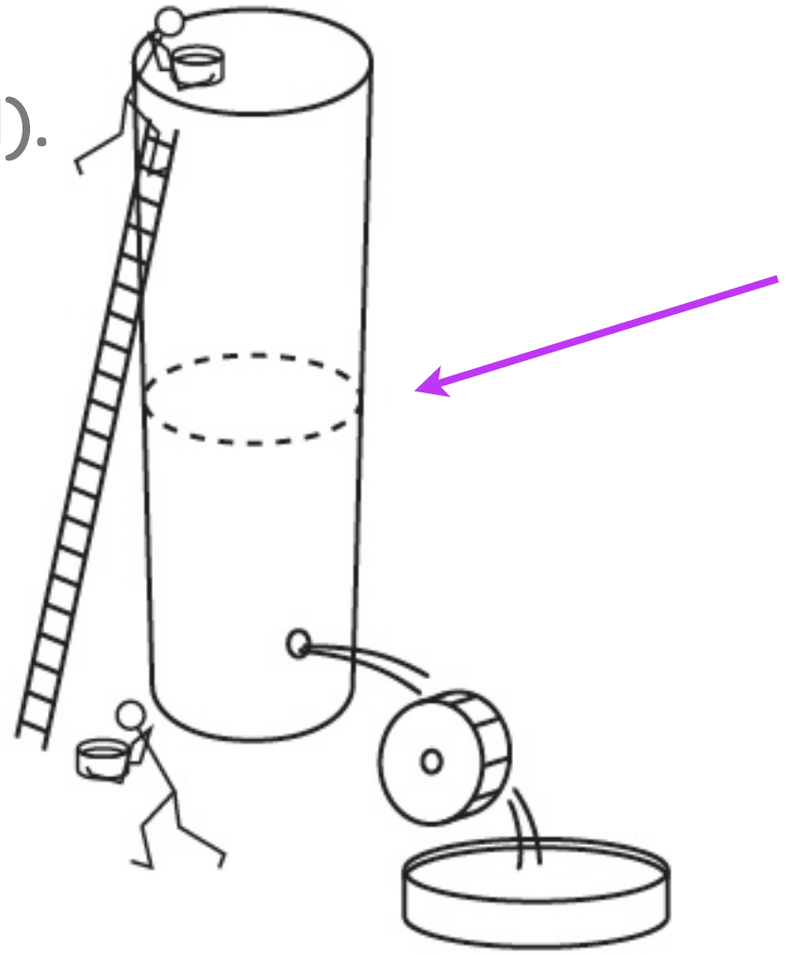
overview: the big three

VOLTAGE, RESISTANCE, AND CURRENT

Voltage

Electrical pressure or force (potential).
Measured in Volts.

The height of the water.



overview: the big three

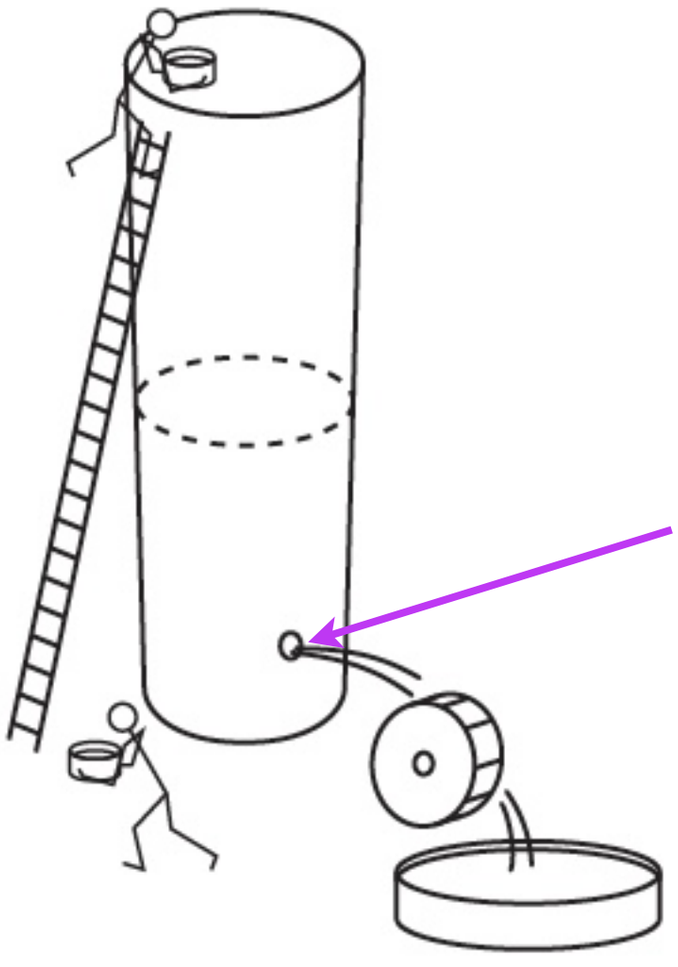
VOLTAGE, RESISTANCE, AND CURRENT

Resistance

The amount that a conductor resists the flow of current.

It is measured in Ohms (Ω)

Size of the hole.



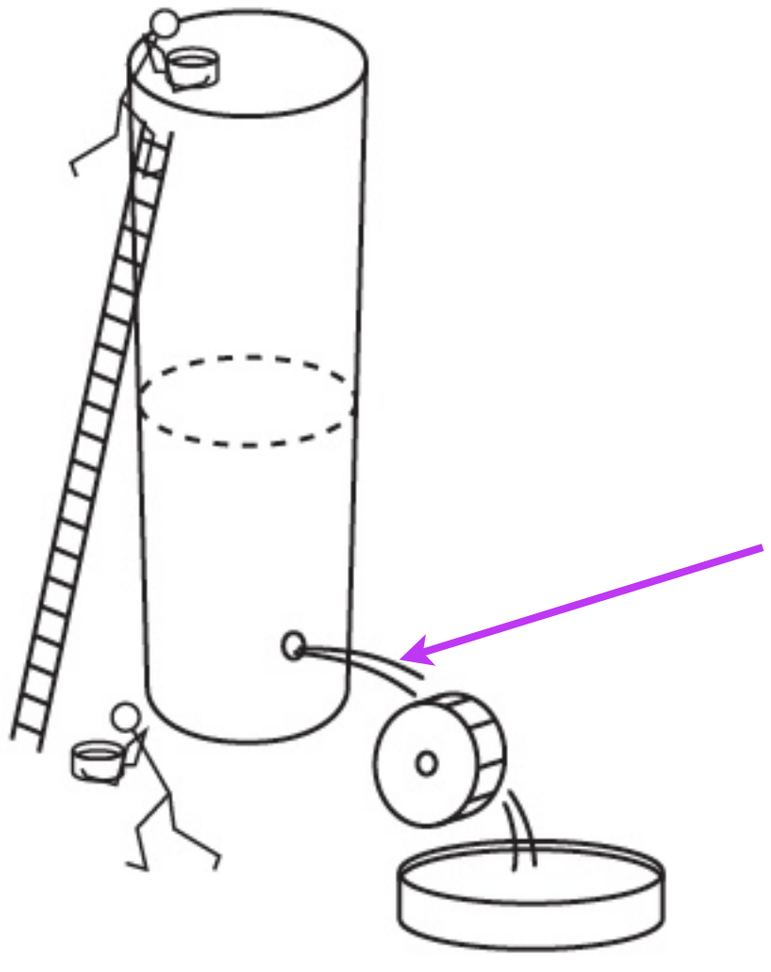
overview: the big three

VOLTAGE, RESISTANCE, AND CURRENT

Current

The quantity of electrons passing a given point in time.
Measured in Amperes (amps).

Volume of flow through the hole.

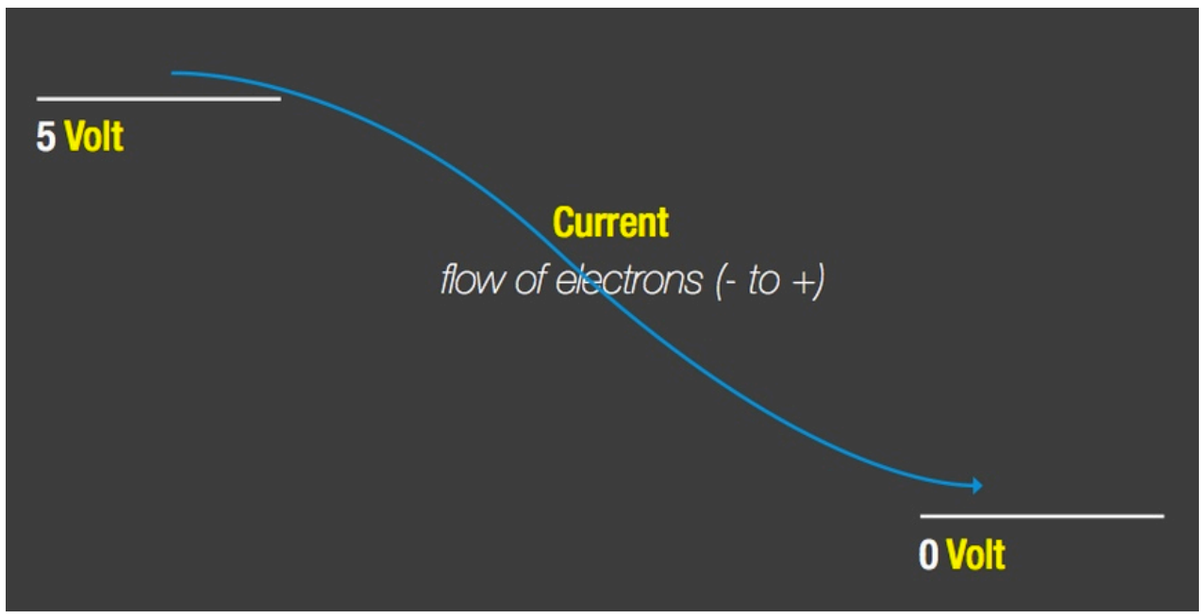


current

HOW DOES IT MOVE?

Current flows from an area of high charge (positive) to an area of low charge).

But remember: *electrons* flow from negative to positive.



current

AC VS. DC (TO THE DEATH)

An electrical current can flow in either of two directions through a conductor.

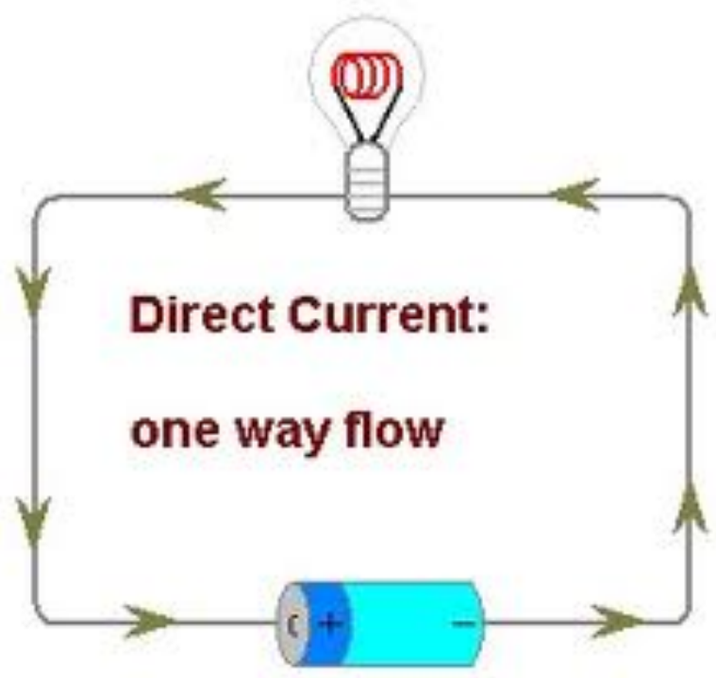
current

AC VS. DC (TO THE DEATH)

An electrical current can flow in either of two directions through a conductor.

If it flows in only one direction (whether steadily or in pulses) it's called Direct Current (DC).

This is the type of current you get from a battery (or from your computer).



current

AC VS. DC (TO THE DEATH)

An electrical current can flow in either of two directions through a conductor.

A current which alternates in direction or polarity is called Alternating Current (AC).

We will only be working with Direct Current.

resistance

YOUR ELECTRICAL BODYGUARD

A resistor limits the amount of electricity that can flow through a certain point.

If we didn’t have these, we would fry our components.

We’ll get into all the pretty colors in a sec.

voltage

HOW MUCH WORK CAN YOU DO?

Voltage is the potential for doing work. The more voltage you have, the more you are capable of putting in long hours.

If we didn’t have these, we would fry our components.

We’ll get into all the pretty colors in a sec.

another analogy

THE CAFFINATED DT-ER

Voltage is the potential for doing work. The more voltage you have, the more you are capable of putting in long hours.

Perhaps another analogy is appropriate...

Caffeine in DT.
Without it, you might do this...

ohm’s law

THEY ARE ALL RELATED!

Given any of two the previous, you can find the remaining two by using Ohm’s law.

$$V = I \times R$$
$$I = V/R$$
$$R = V/I$$

V = difference in voltage between two points in a simple circuit
R = the resistance in ohms between the same two points
I = the current in amps flowing through the circuit between the two points.

ohm’s law

THEY ARE ALL RELATED!

Why would you need this?

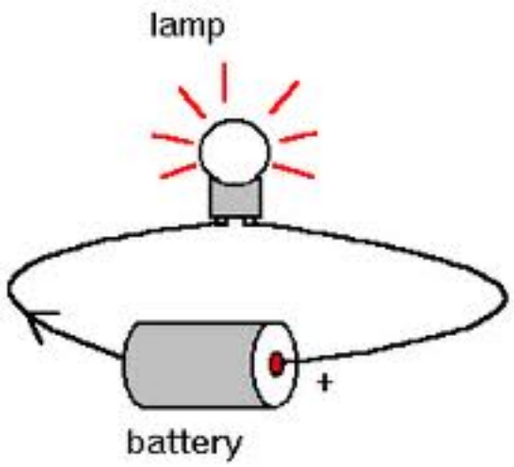
Because we are going to start building circuits!

circuits

MUCH SIMPLER THAN IT SOUNDS.

A circuit is a path that electrical current flows through. Circuits are made from conductive material. Electricity can flow through any material that is conductive.

A circuit can be as simple as a battery connected to a lamp or as complicated as a digital computer.



conductors

LET IT FLOW

A material where the electrons are free to move around and create electric currents.

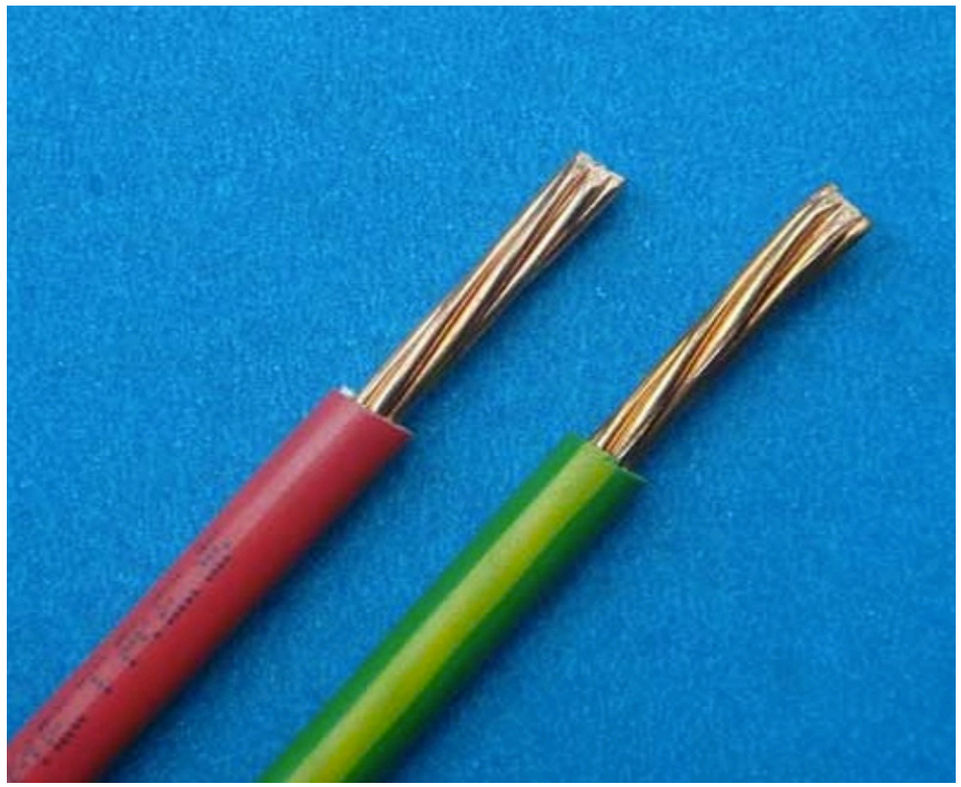
Examples: copper, aluminum, silver, steel, gold, etc.
Keep in mind different conductors have different levels of resistance.

insulators

NOT SO MUCH FLOW

Insulators have the opposite effect on electrons. Electrons are not able to easily move around within insulators.

Examples: glass, plastic, rubber, air, wood

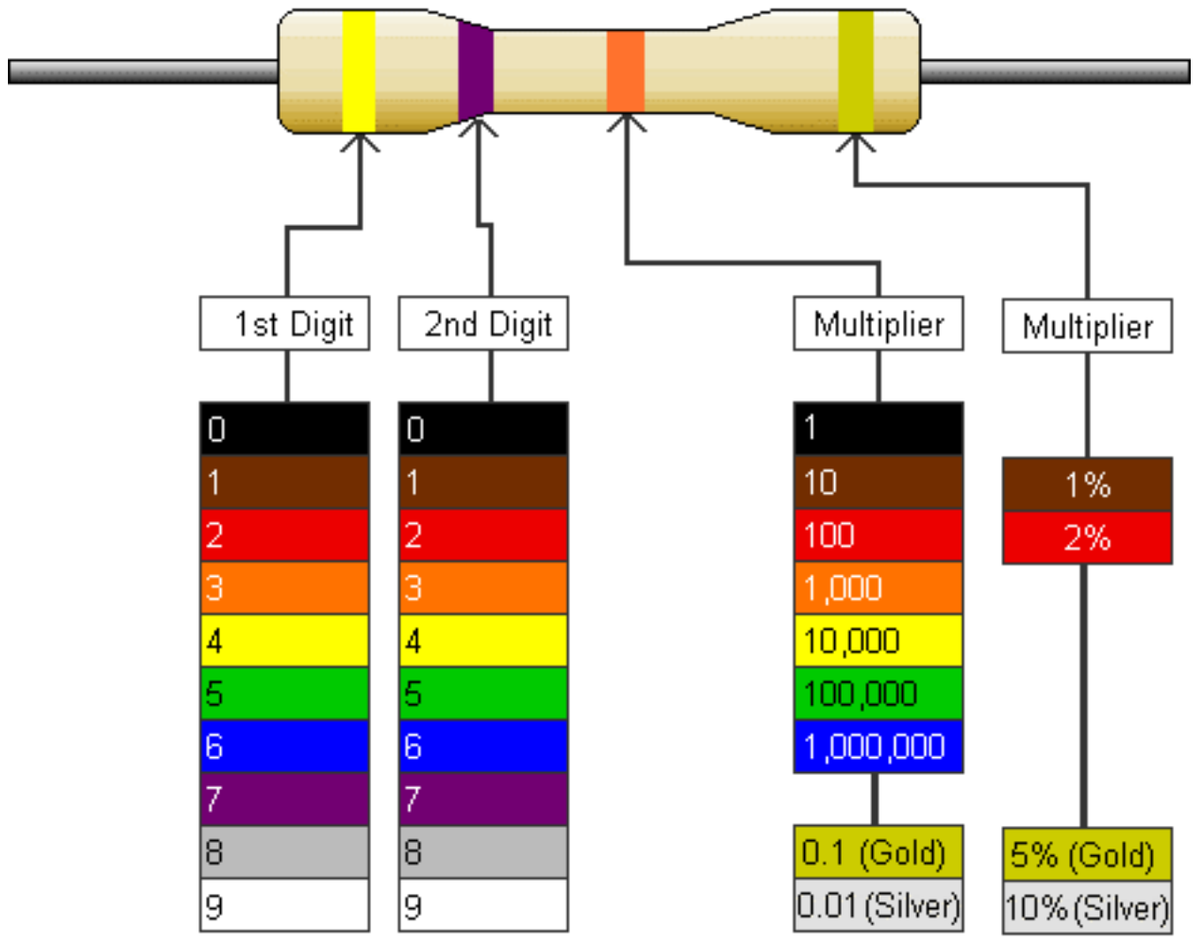


resistors

COLOR-CODED

Resistors have an interesting coding system.

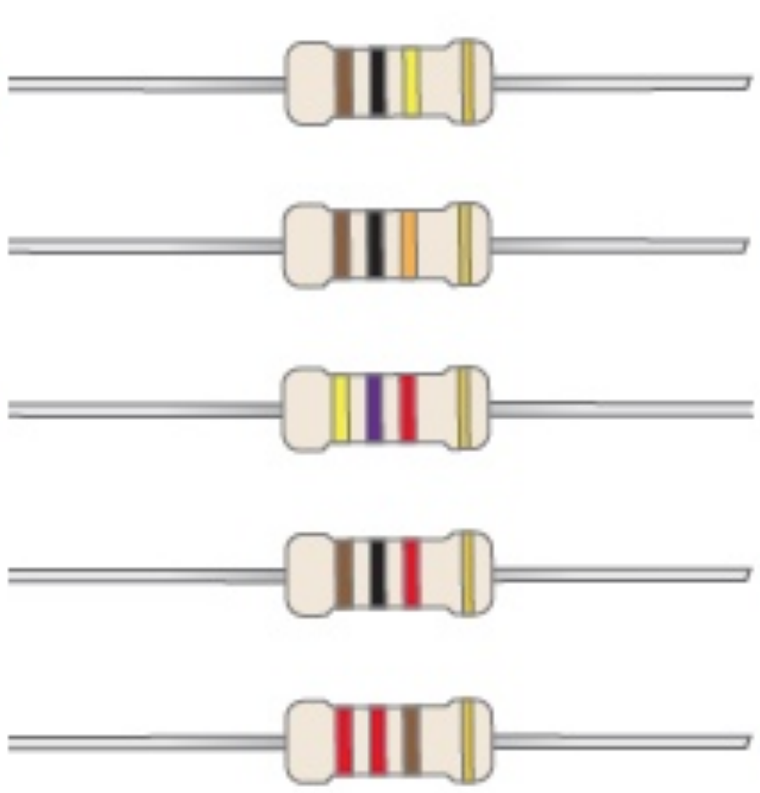
Become well-acquainted with it.



resistors

COLOR-CODED

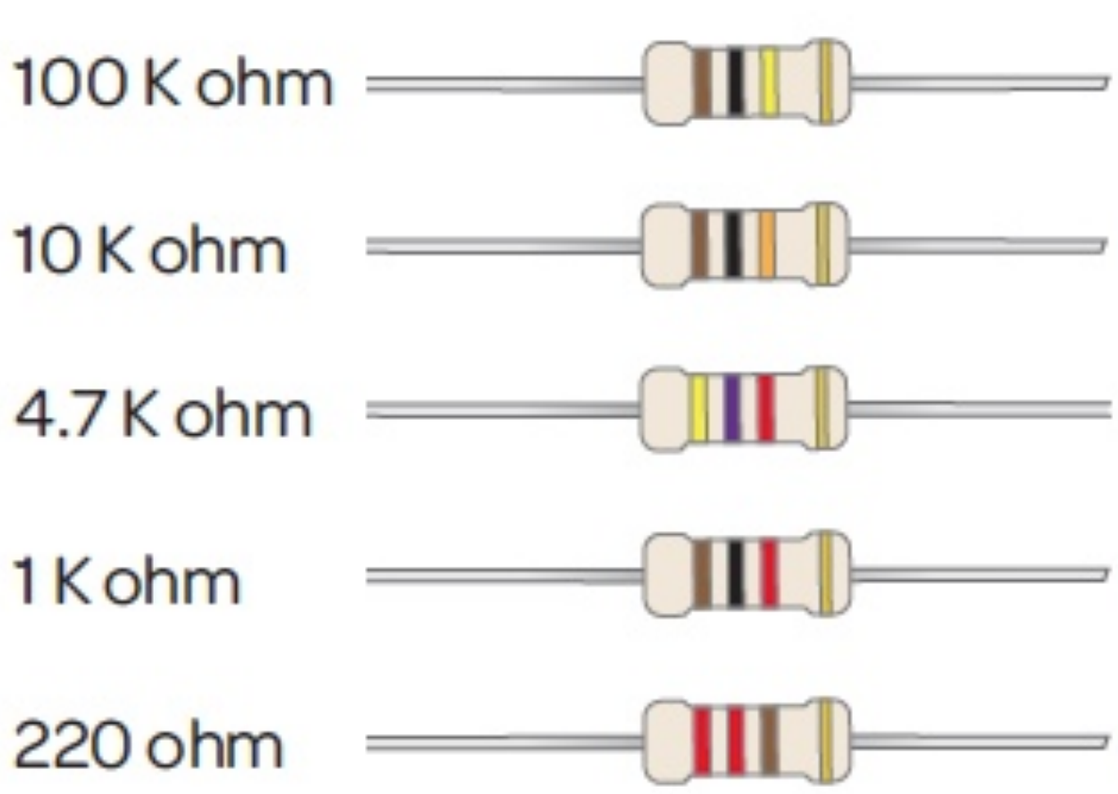
What are the values?



resistors

COLOR-CODED

They are actually quite common...



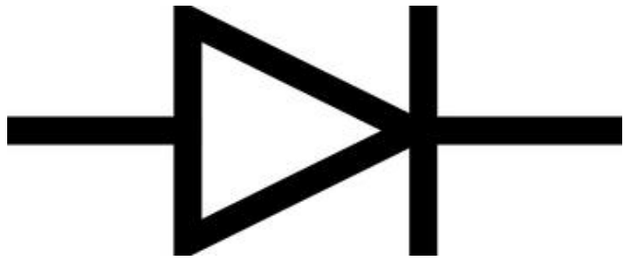
switches

speakers

LEDs

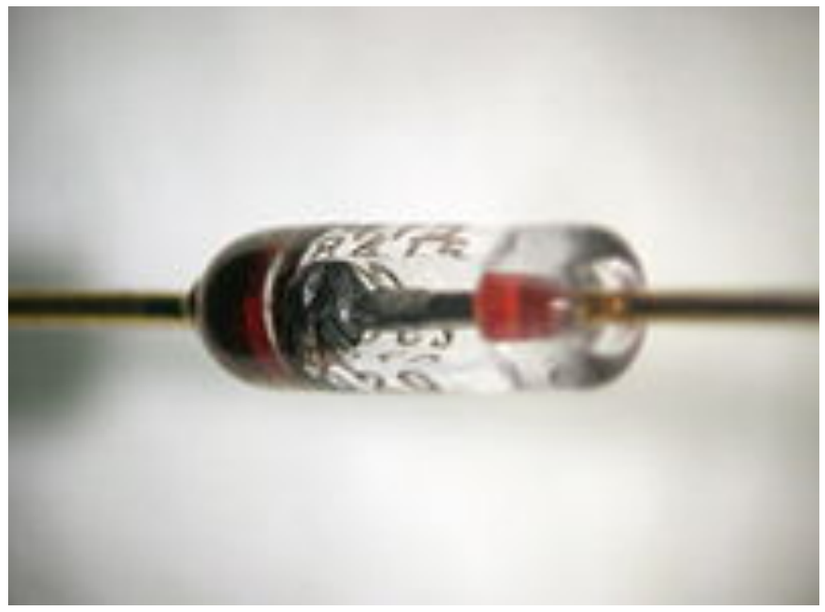
diodes

ONE WAY STREET



An electronic component made up of a semi-conductive chip, which only conducts electricity in one direction.

We’ll only be dealing with one type of diode:
Light Emitting Diodes

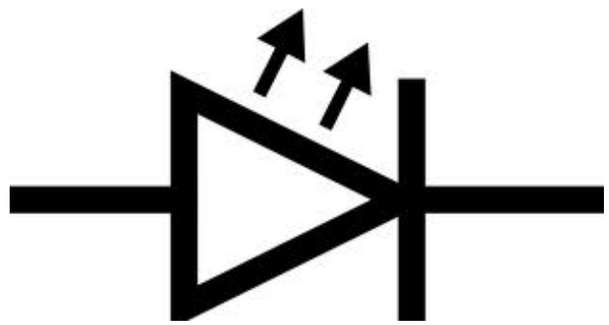


LEDs

PRETTY

LEDs

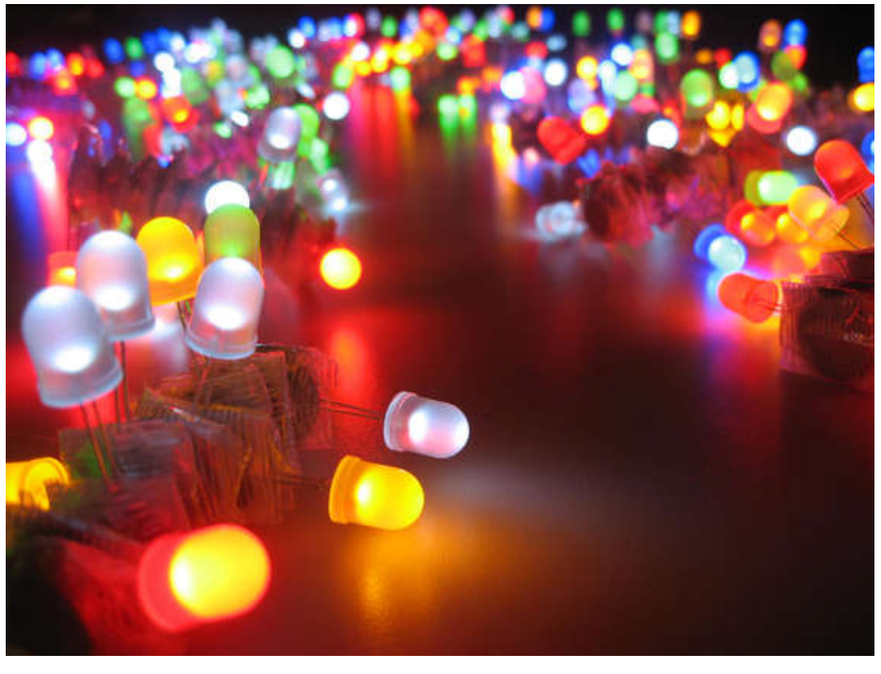
THE SPECIAL DIODES



All diodes emit some electromagnetic radiation when forward biased.

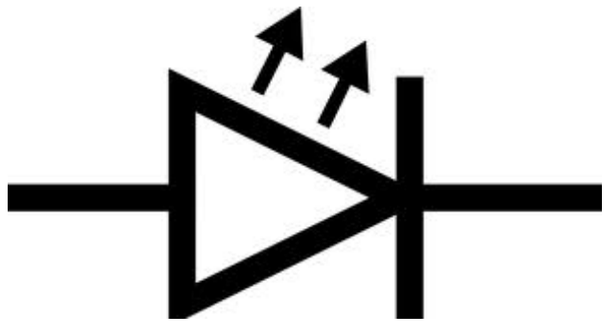
Diodes made from certain semiconductors (like gallium arsenide phosphide) emit considerably more radiation than silicone diodes.

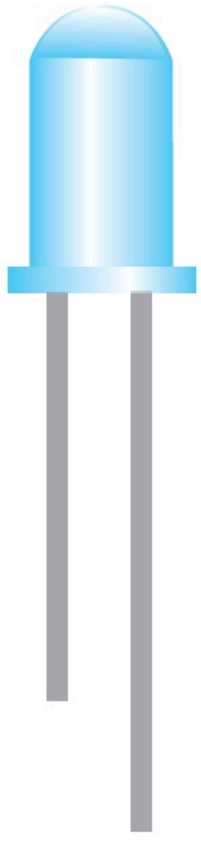
= They Light UP!



LEDs

THE SPECIAL DIODES





CATHODE

ground

-

ANODE

power

+

breadboard

BREAK IT TO MAKE IT

A prototype board for putting together circuits.

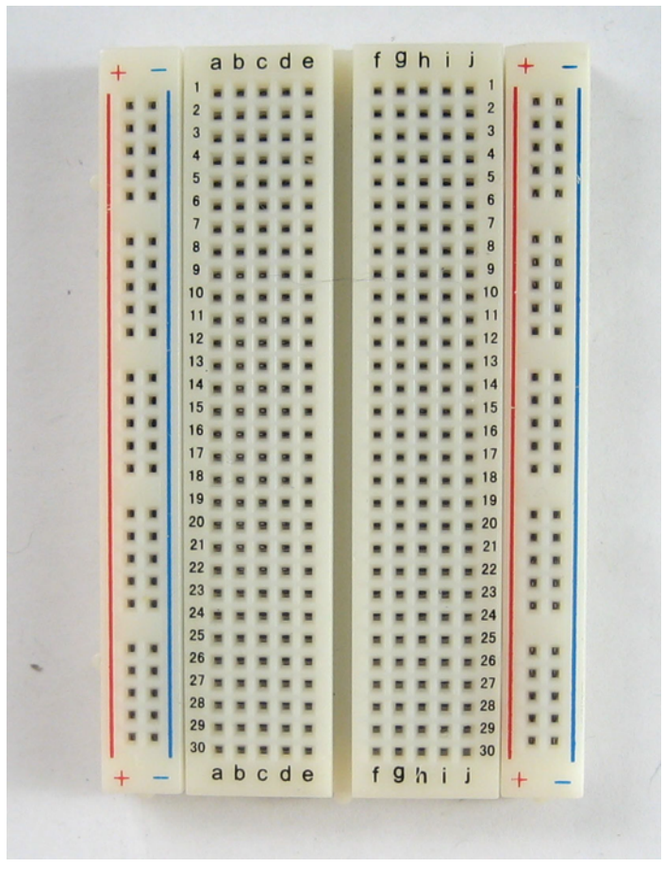
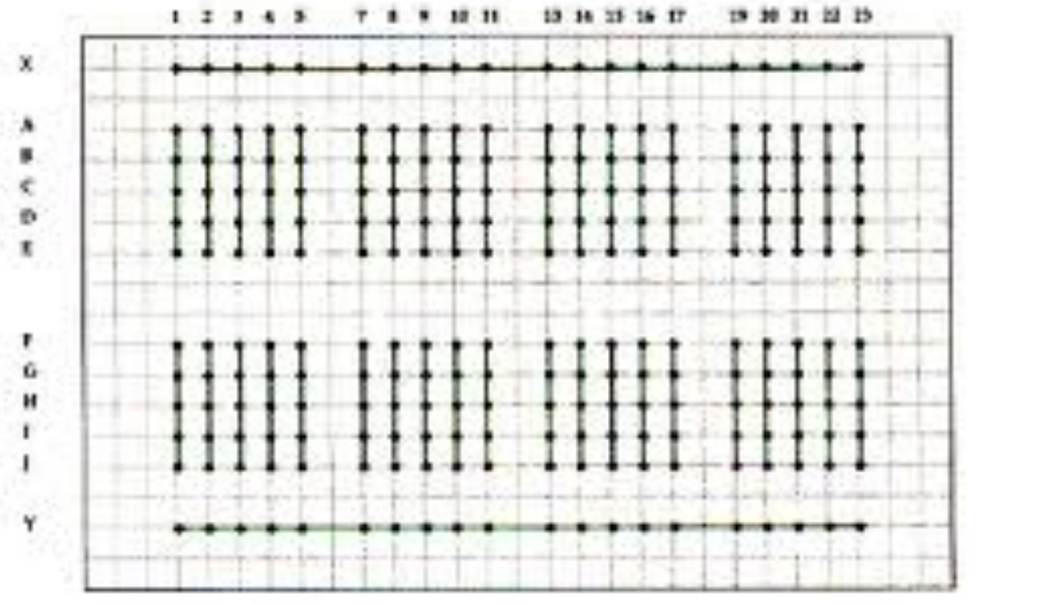


Figure 1. Pin Diagram of a Solderless Breadboard

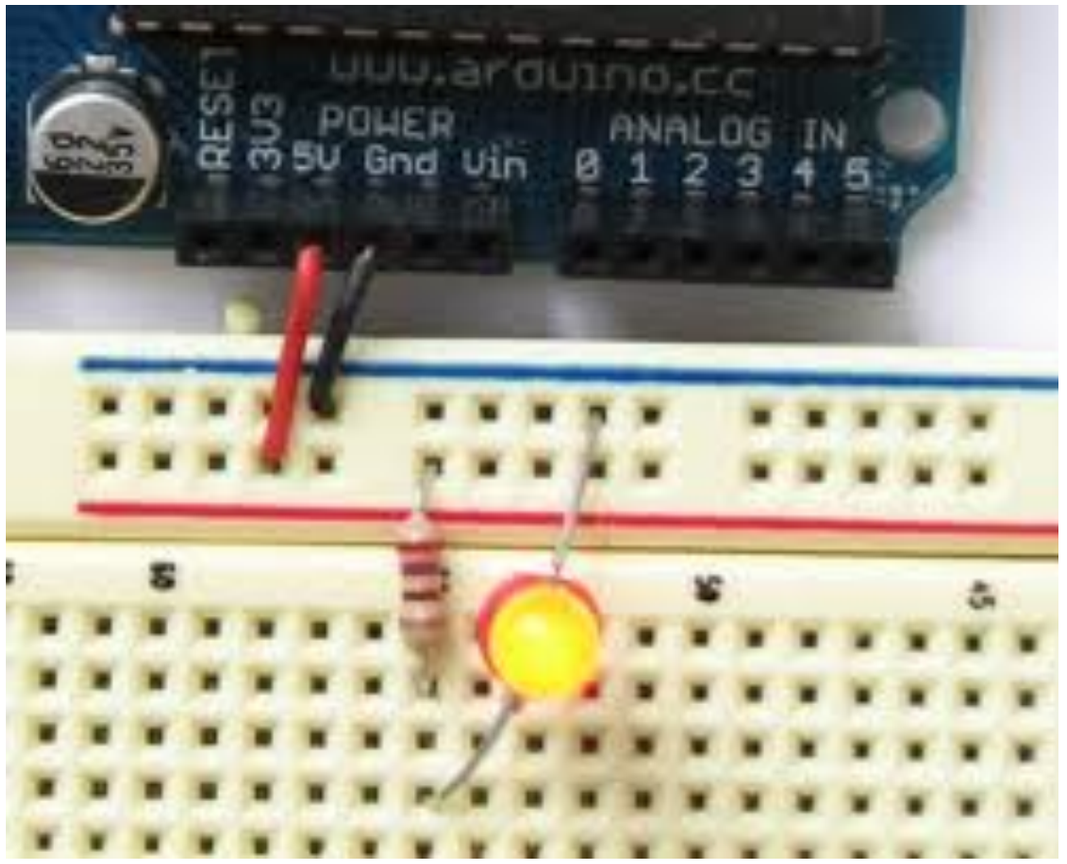


Top view of a solderless breadboard. Colored lines indicate internal connections. Dots mark plug points.

make light!

BE PROMETHEAN

Make an LED light up.



field trip

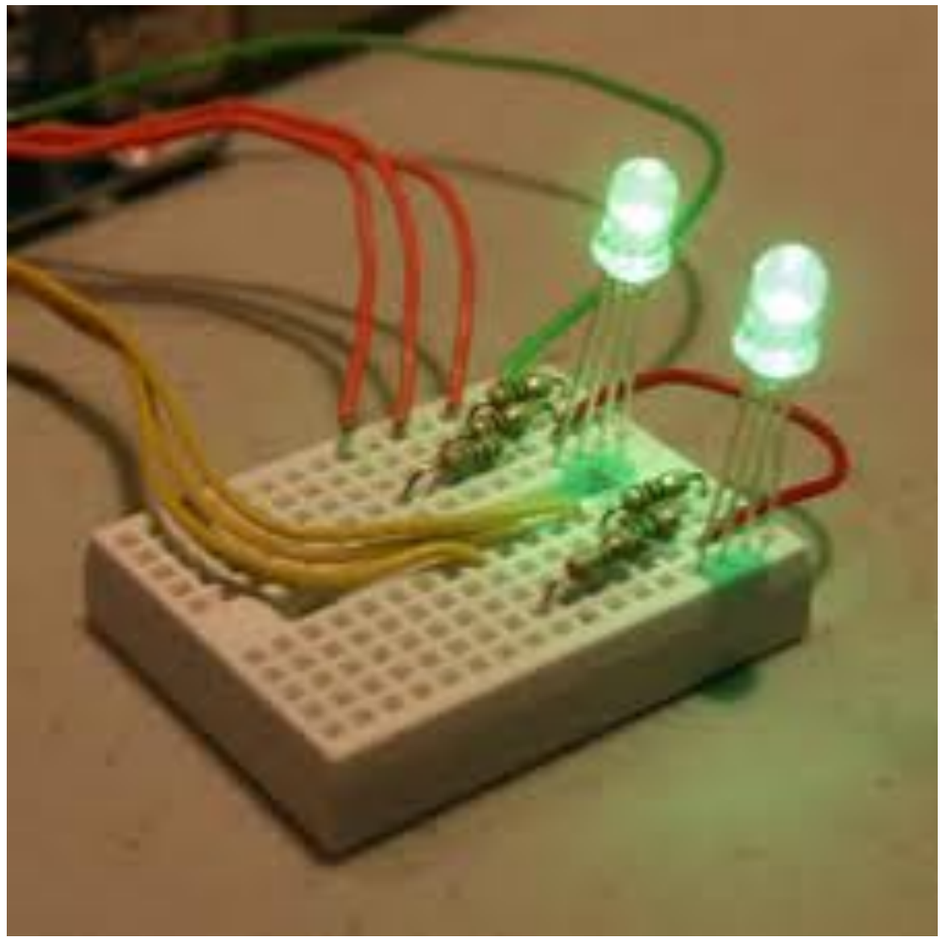
TO THE PCOMP ROOM!

Soooo many resources...so little time.

make light!

BE PROMETHEAN

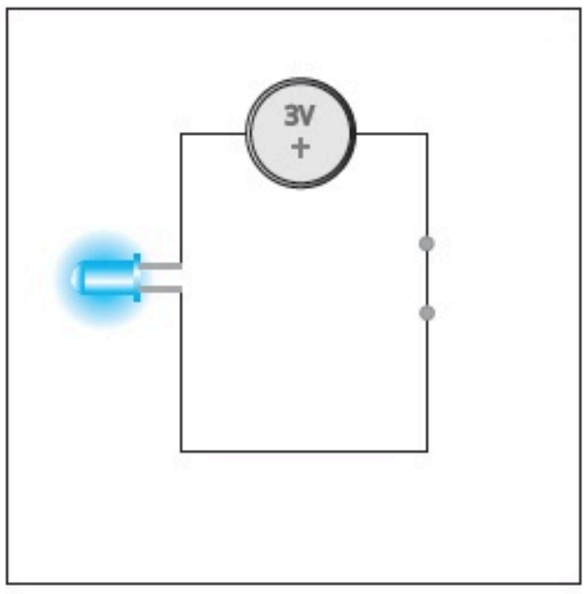
But two LEDs are always better than one...



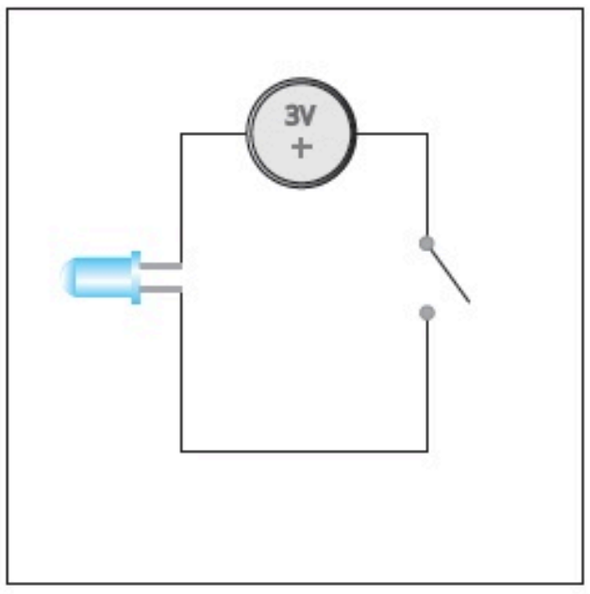
switch

BREAK IT TO MAKE IT

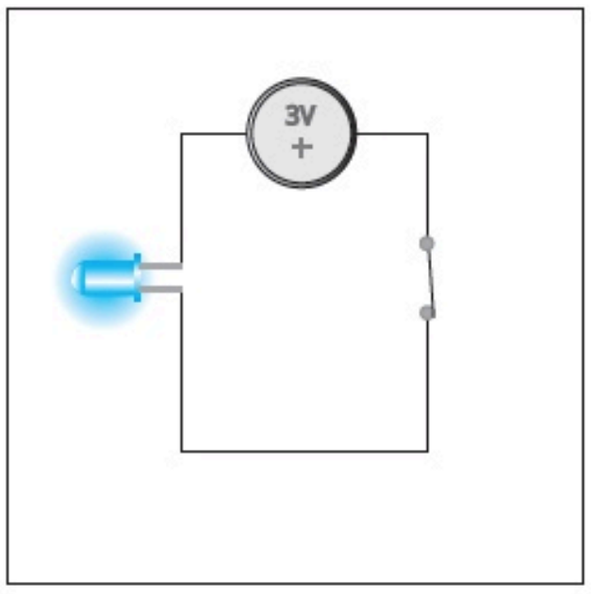
A break in the circuit that can be opened or closed.



The circuit is CLOSED so the LED is ON.



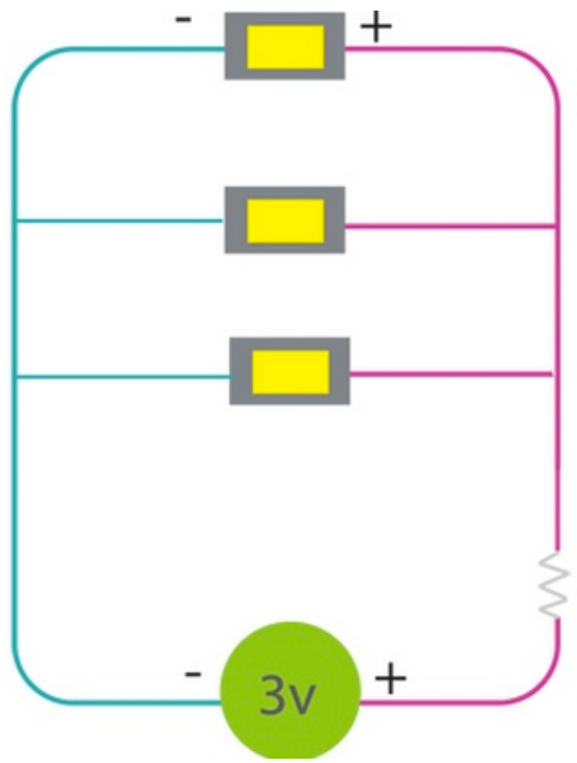
The circuit is OPEN so the LED is OFF.



The circuit is CLOSED so the LED is ON.

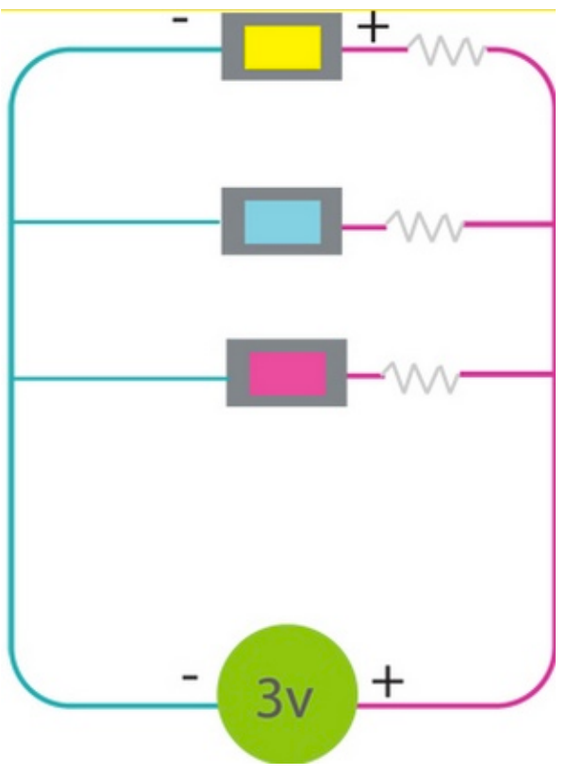
parallel circuits

MORE THAN ONE WAY TO WIRE



You can wire more than one LED in parallel or series.

Parallel circuits share the same VOLTAGE.

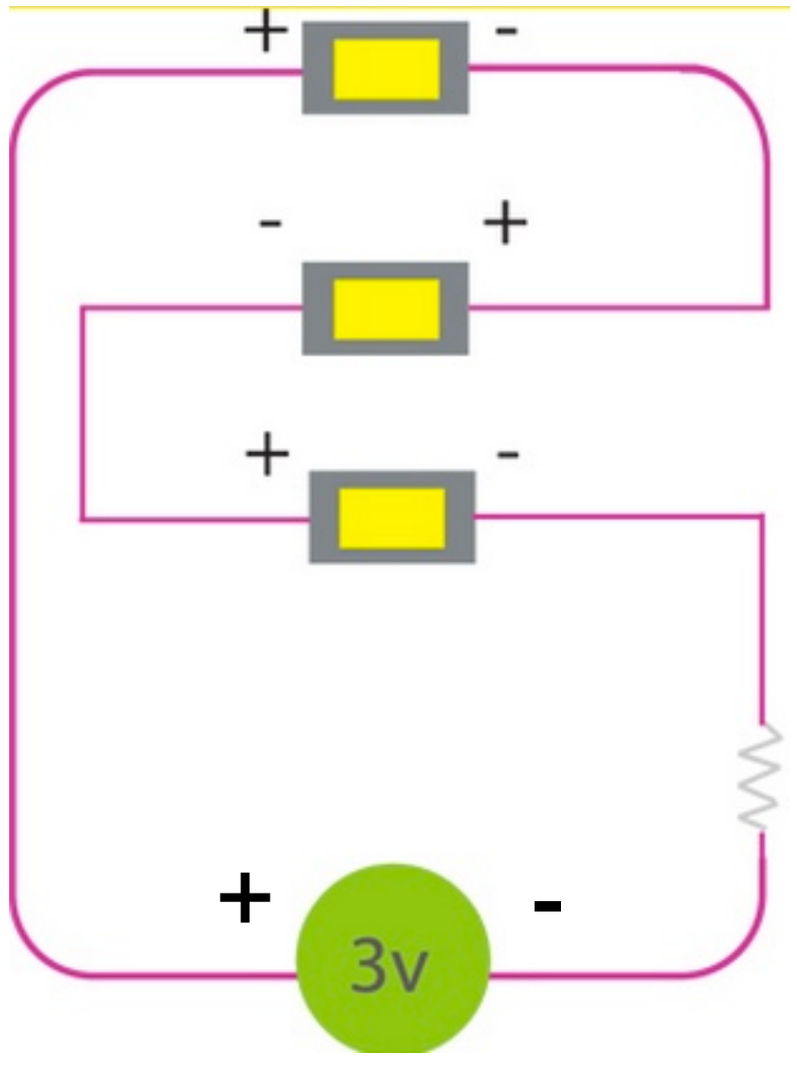


series circuits

MORE THAN ONE WAY TO WIRE

You can wire more than one LED in parallel or series.

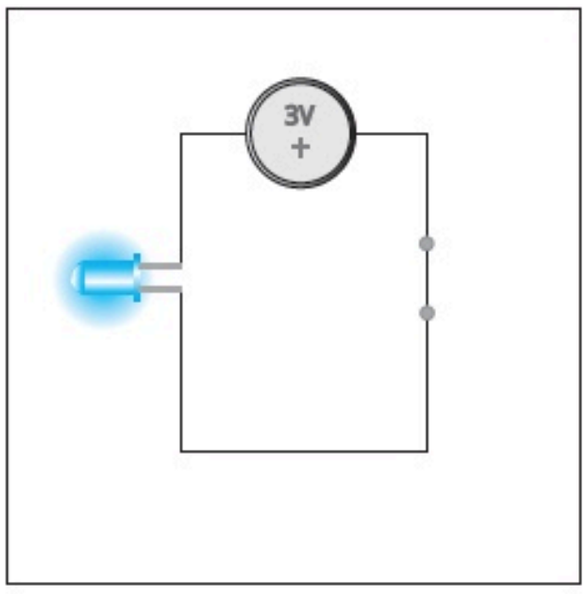
Series circuits share the same CURRENT.



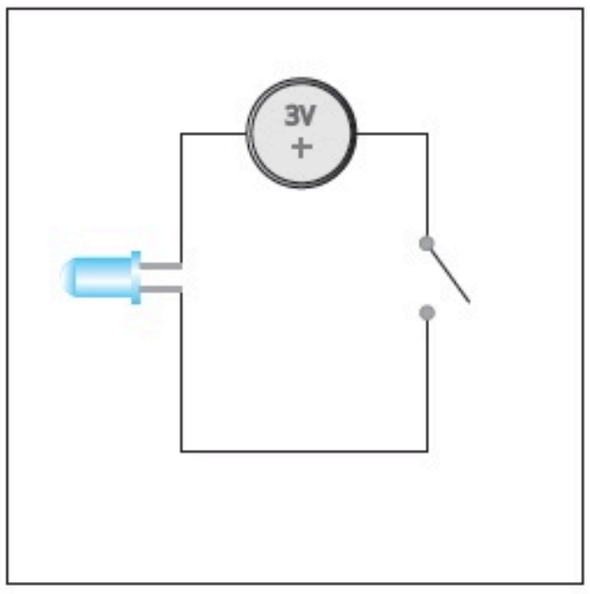
switch

BREAK IT TO MAKE IT

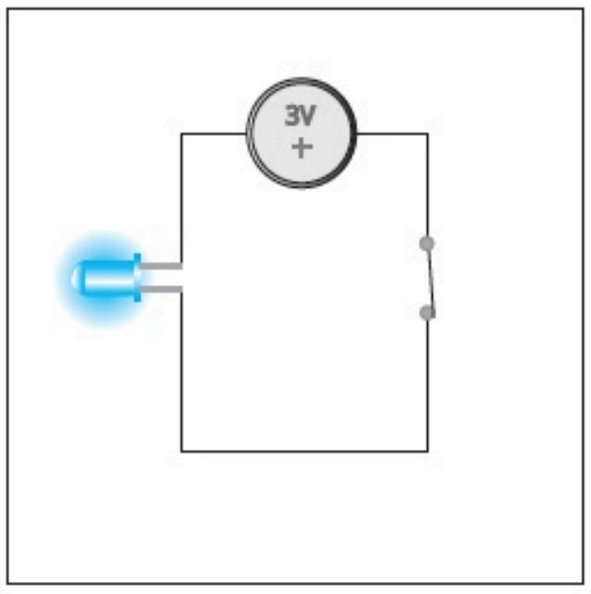
A break in the circuit that can be opened or closed.



The circuit is CLOSED so the LED is ON.



The circuit is OPEN so the LED is OFF.



The circuit is CLOSED so the LED is ON.