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**Welcome back**

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# If I were a...

- A Type of Fruit
  - A Historical Figure
-

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# Recap

# Ground Rules:

1. Treat *everyone* with respect
2. Don't be afraid to ask questions / work together
3. If you think it would make **Dr. B mad**, *it will*
4. Don't shout out answers, Dr. B will call on you. Give everyone an opportunity to think about the answers.
5. **No cell phones**. If you really want to take pictures for snap-book, ask.
6. Take the learning seriously, but have fun!

# The Anatomy of a Linux Command

sudo program options -flags



- This is optional and you should use it with caution. It stands for “Super User Do”.
- Use when you need to install or update software or access restricted files



- Here I say program but there are also built-in commands in linux that you would write here
- Try typing “ls” into your command line



- Some programs run fine on their own and some need extra options or commands

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# Basic Electronics

Samuel Bechara, PhD

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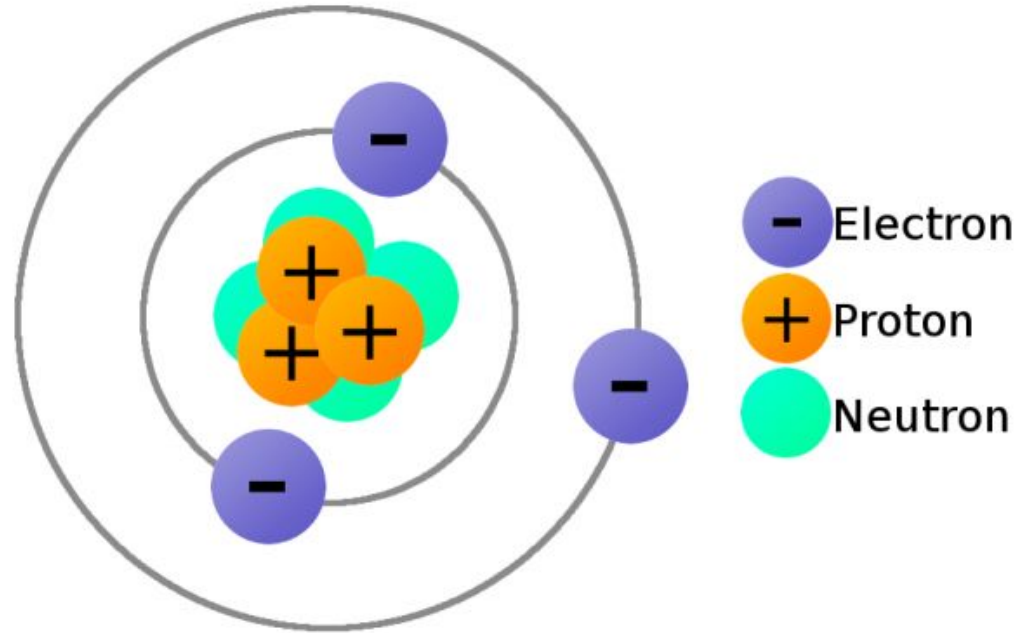
# What do **you** use electricity for?



# What is electricity?

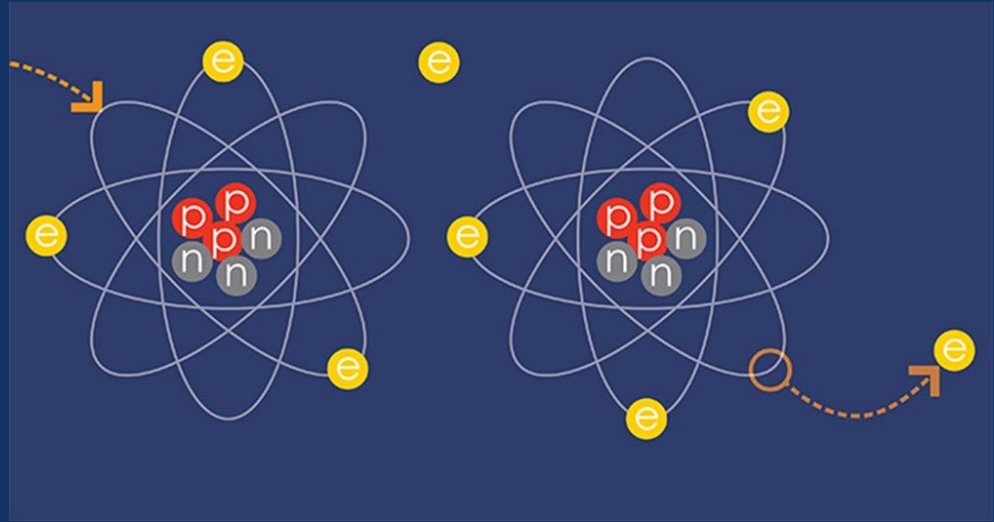
## THE ATOM

To understand, we have to dive deep into one of the smallest units of matter in the universe!

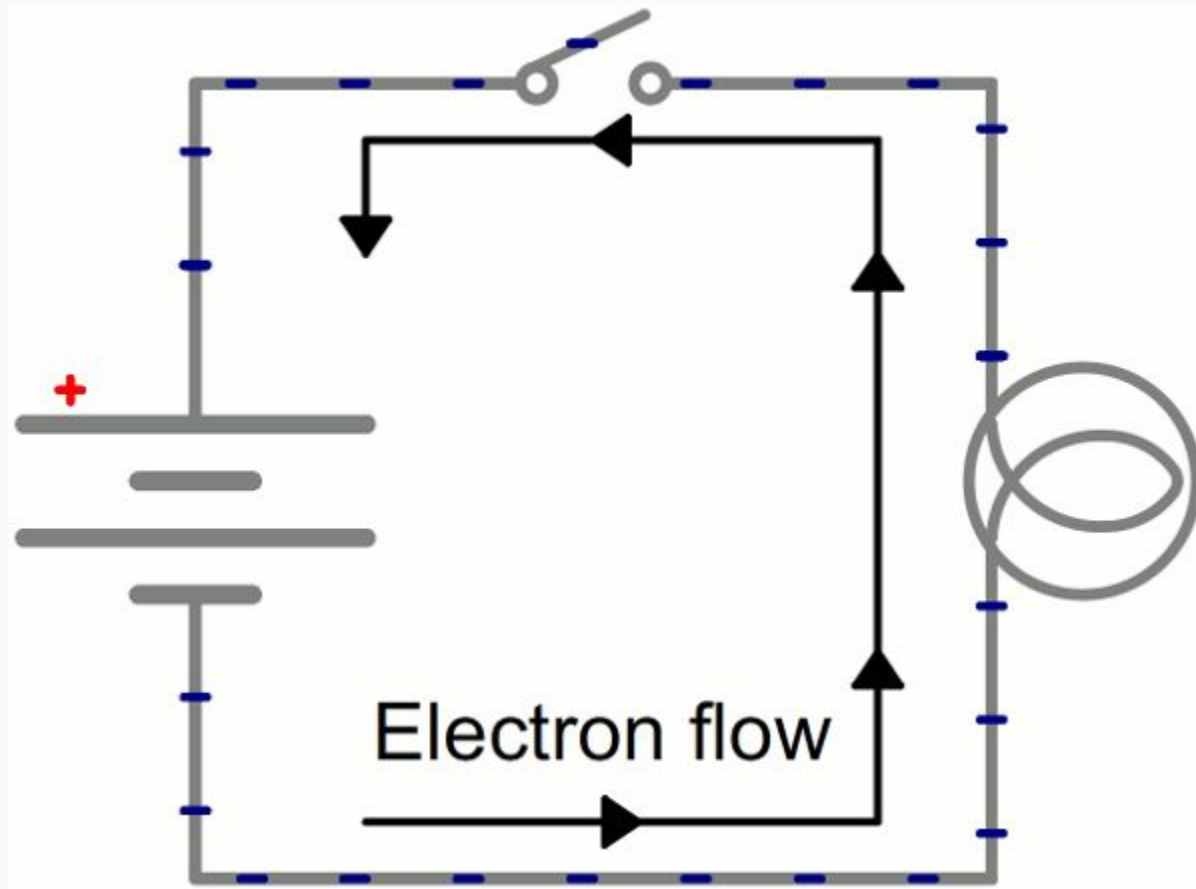




# Electricity is the flow of electrons



**In order for electrons to flow, there needs to be a “circuit”**



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# Why do electrons flow?

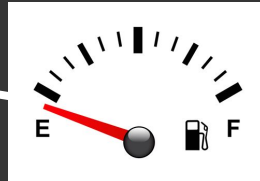


# The Universe is LAZY

Water has a LOT of energy at the top of the waterfall \*



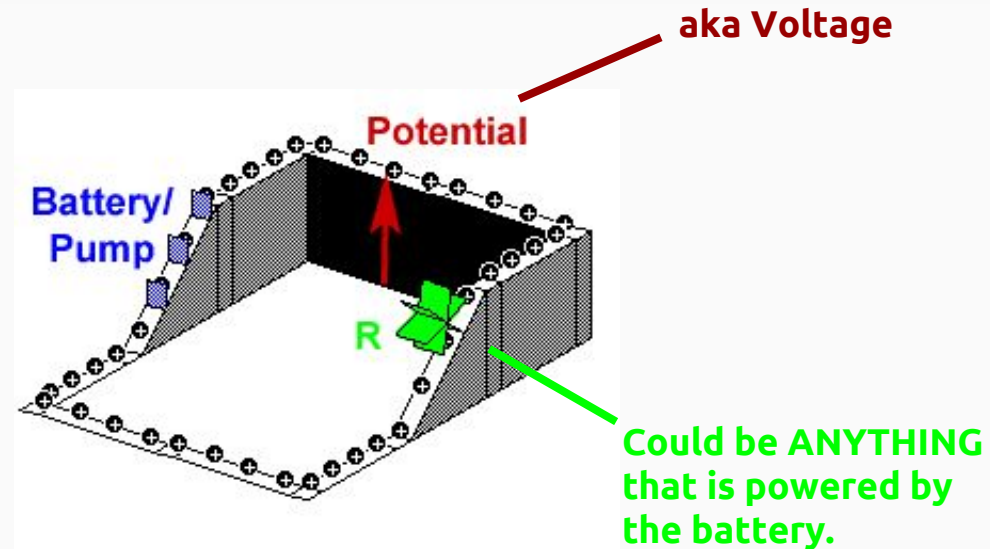
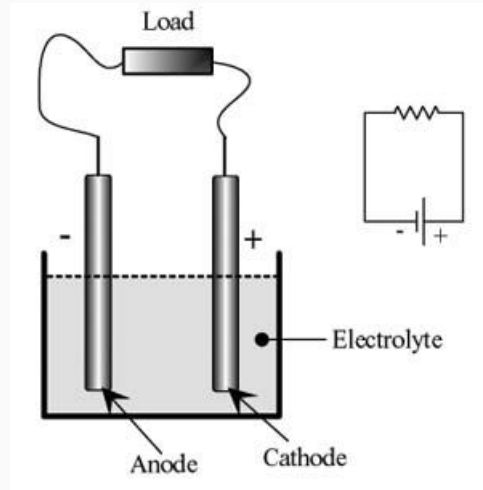
Water loses all of it's energy at the bottom of the waterfall \*



\* Technically, gravitatonal potential energy was converted to kenetic energy and likely heat. But you get the idea...



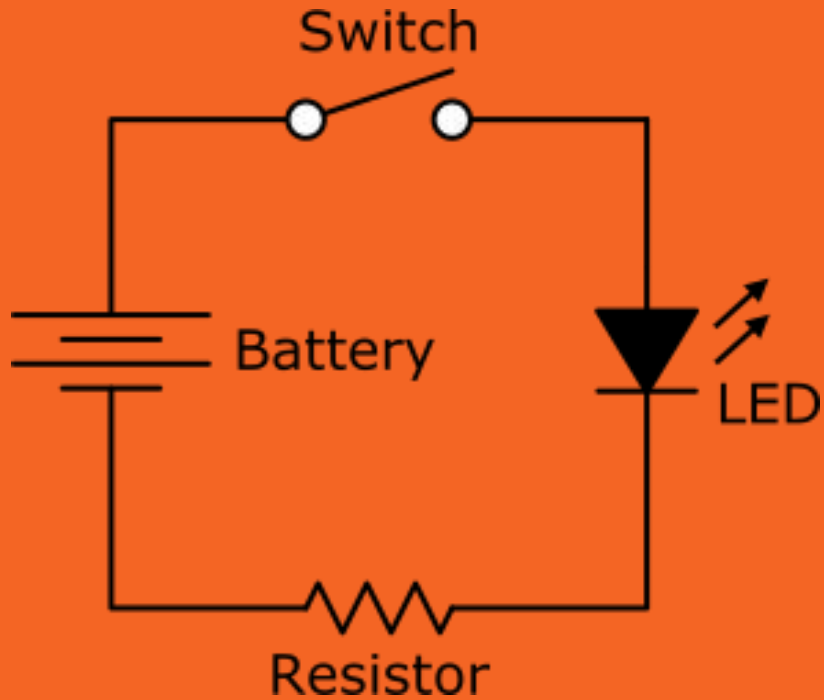
# What does a battery do?



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# What do **you** use batteries for?

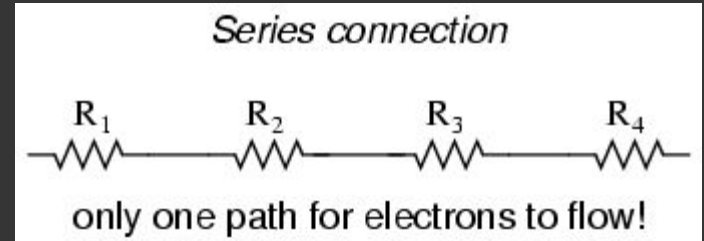




# Circuit Drawing Basics

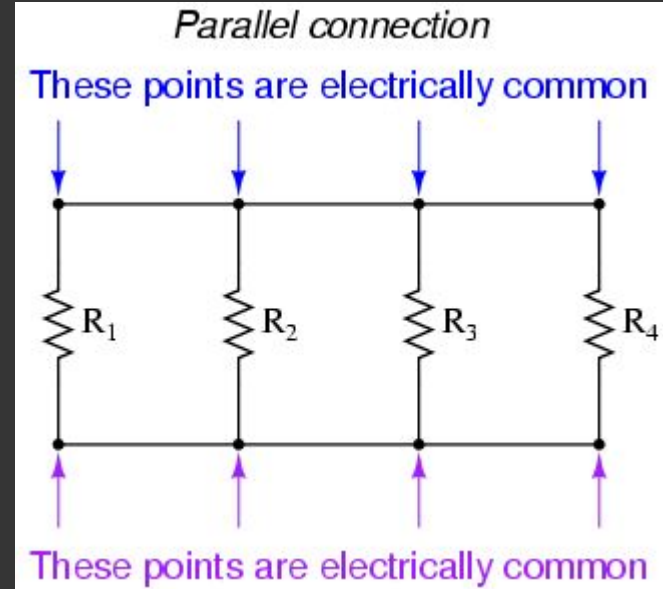
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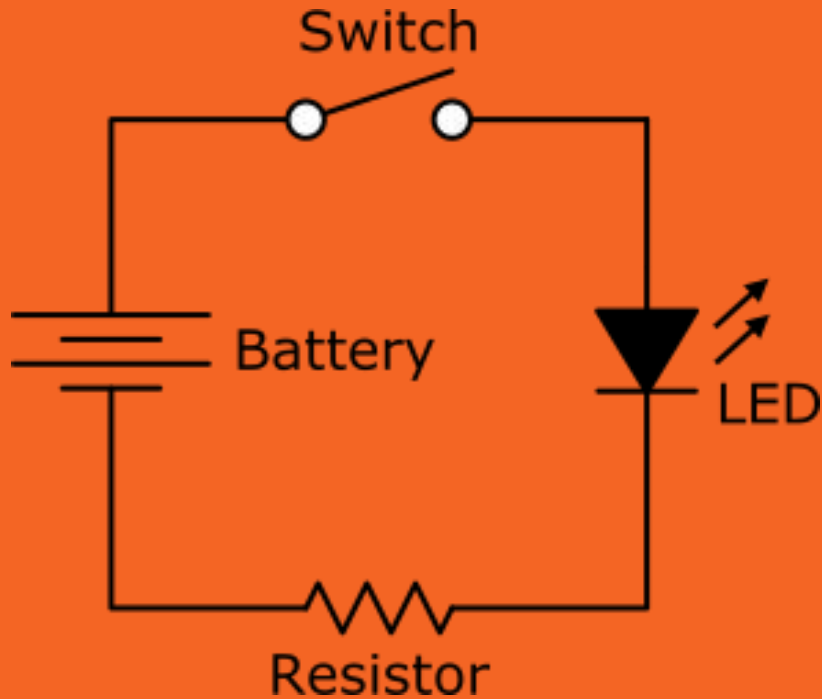
# Series Connection





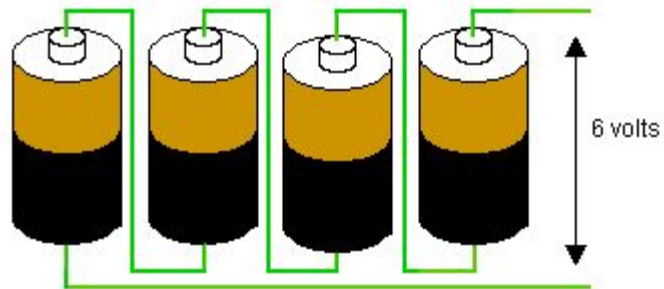
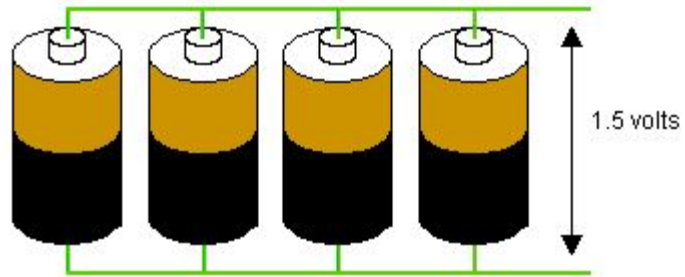
# Parallel Connection





**Let's look  
at this  
again...**

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Which is which?

Why put batteries in series or in parallel?

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Could be any load...  
like a light bulb

# HINT

Discontinuous Methods

Ac solution



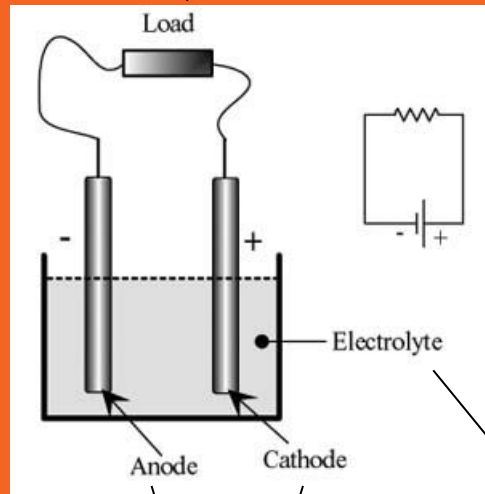
## Make a battery

Now you are going to be given everything  
you need to make a battery

- Lemons
- Nails
- Pennies
- Wires
- LED

Be sure to draw the circuit diagram of your  
lemon battery circuit when you are done!

Could be any load...like an LED



Dissimilar Metals

Acidic  
solution

# Make a battery

Now you are going to be given everything you need to make a battery

- Lemons
- Nails
- Pennies
- Wires
- LED

Be sure to draw the circuit diagram of your lemon battery circuit when you are done!



**SUPER  
BATTERY  
LIGHT BULB  
DEMO!!!!**

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**What did we learn?**



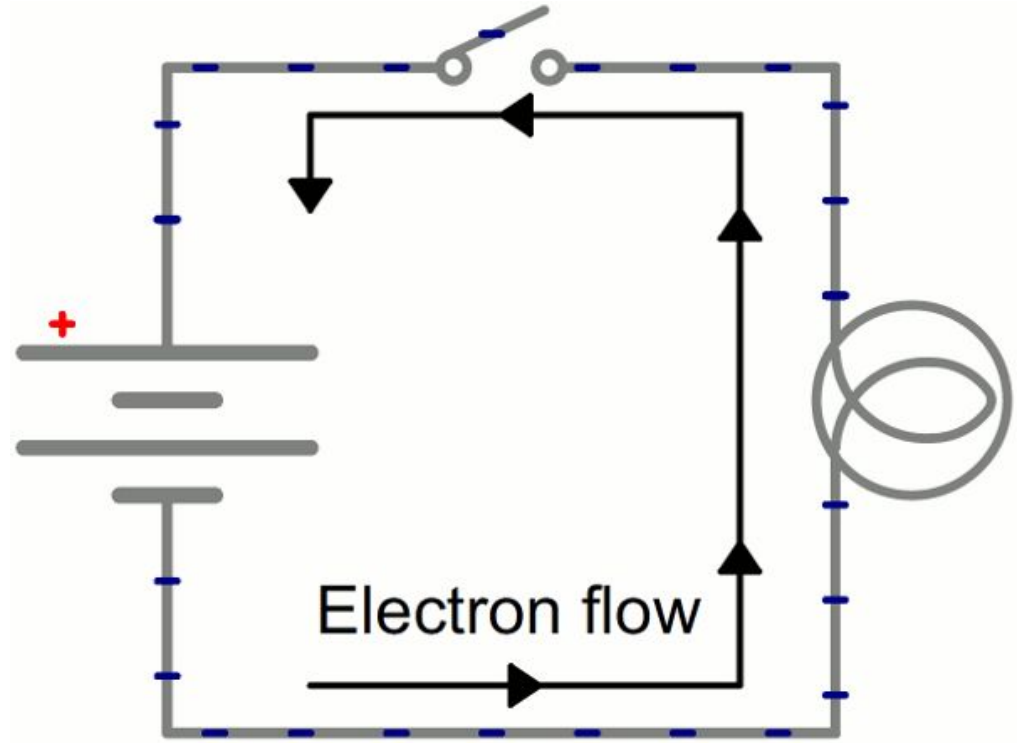
The background of the image is a dark blue, textured surface representing a printed circuit board (PCB). It is covered with a complex network of light blue and white lines, which are the conductive traces of the circuit. These traces form various loops, straight paths, and junctions. In the lower-left quadrant, there is a square, dark-colored microchip. The top surface of the chip is densely populated with a grid of small, circular solder pads. In the center of the chip, there is a smaller, rectangular area with some internal circuitry visible. The overall lighting is soft, creating a professional and technological aesthetic.

# Advanced Electronics

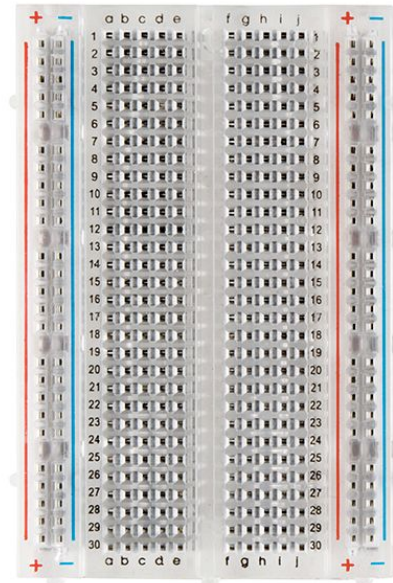
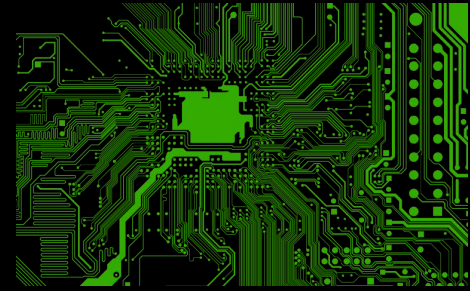


What do we  
need to  
have  
electrons  
flow?

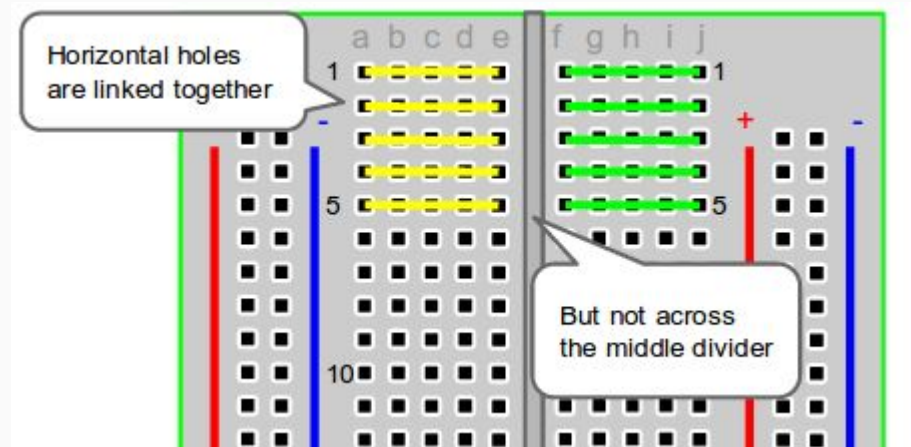
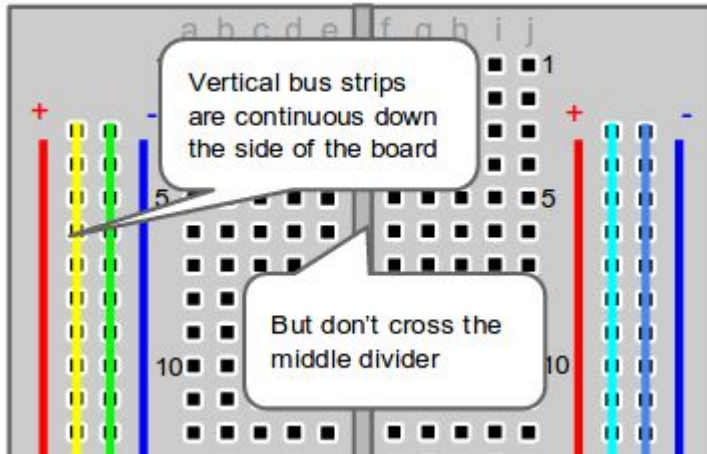
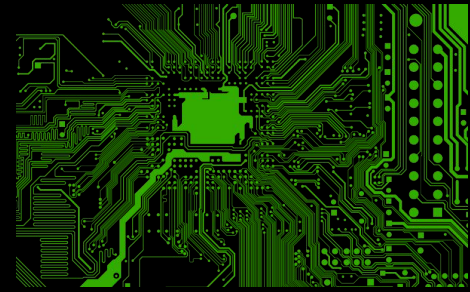
## CIRCUIT!



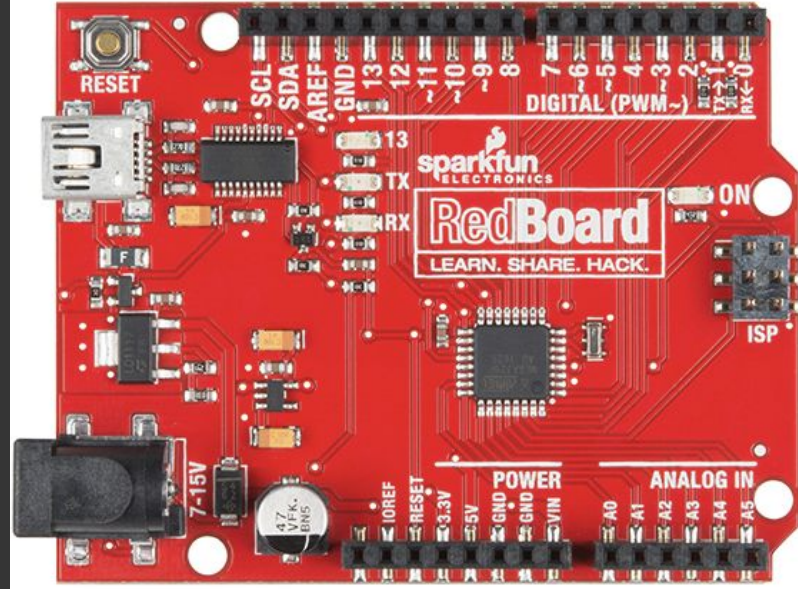
# Breadboards can help!

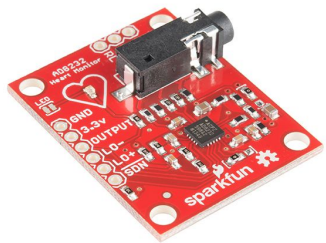


# Breadboards can help!

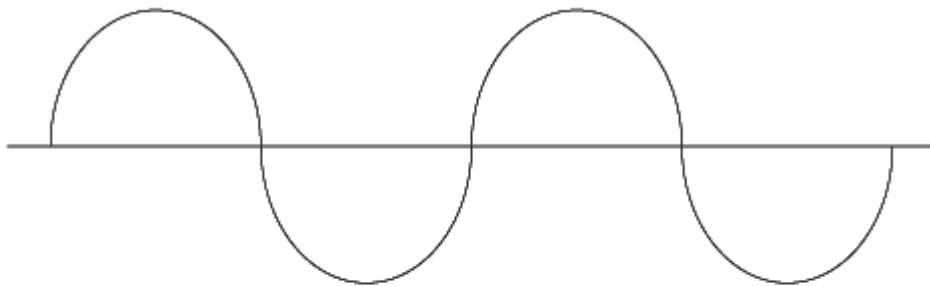


What do **you**  
need the  
arduino for?

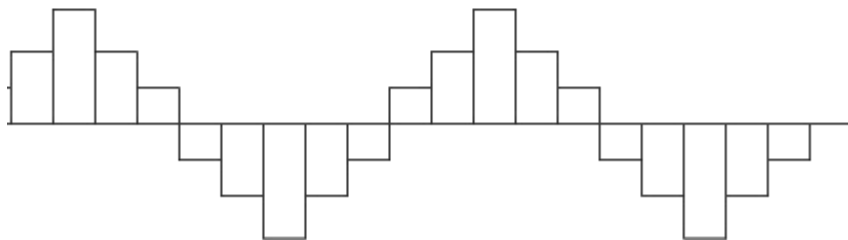




## Analog

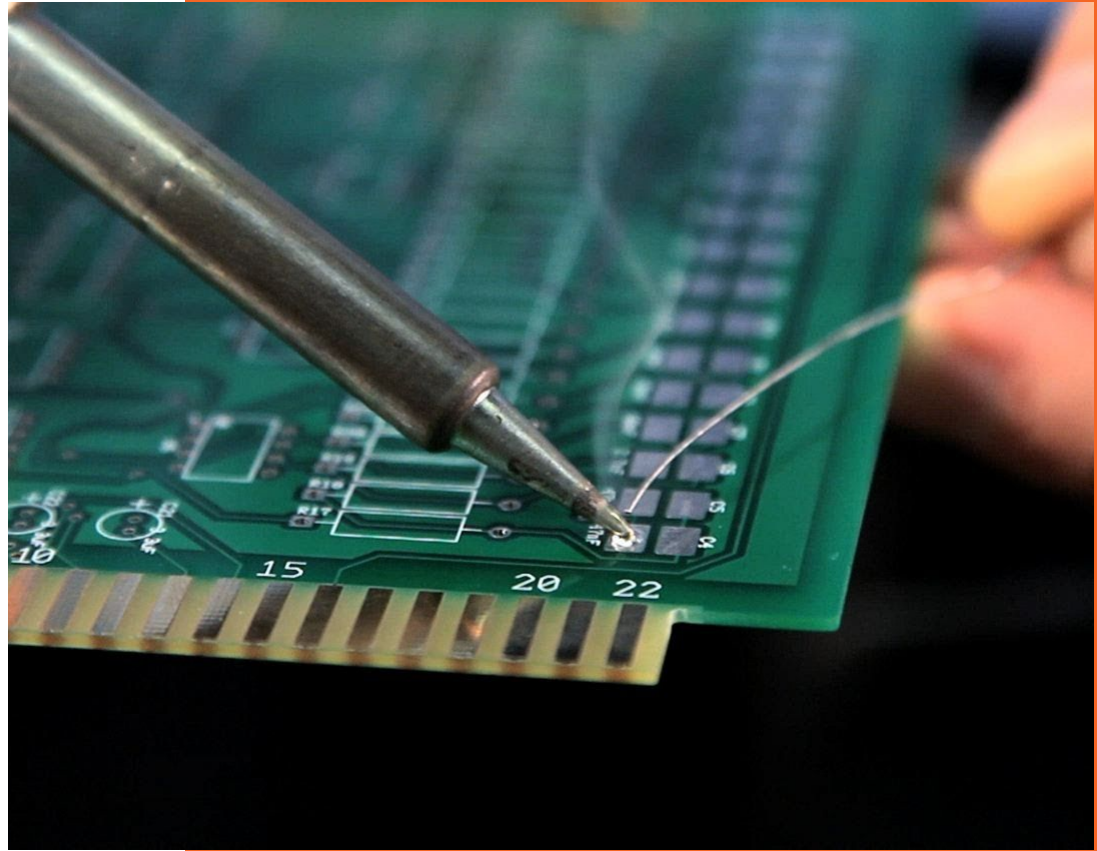


# Digital



# Soldering

What is it for?



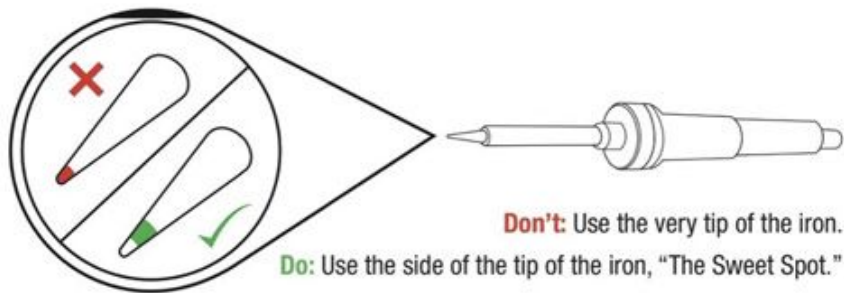


# Solder Safety



- **Always** use **safety glasses** and **gloves**.
- **Always** place a hot soldering iron in its holder.
- **Never** solder near flammables.
- Report any burns immediately.





**Do:** Touch the iron to the component leg and metal ring at the same time.



**Do:** While continuing to hold the iron in contact with the leg and metal ring, feed solder into the joint.



**Don't:** Glob the solder straight onto the iron and try to apply the solder with the iron.



**Do:** Use a sponge to clean your iron whenever black oxidation builds up on the tip.



**A**

Solder flows around the leg and fills the hole - forming a volcano-shaped mound of solder.



**B**

**Error:** Solder balls up on the leg, not connecting the leg to the metal ring.  
**Solution:** Add flux, then touch up with iron.



**C**

**Error:** Bad Connection (i.e. it doesn't look like a volcano)  
**Solution:** Flux then add solder.



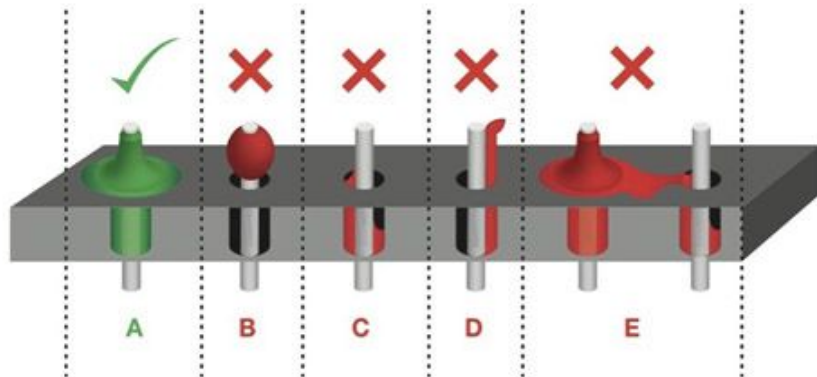
**D**

**Error:** Bad Connection...and ugly...oh so ugly.  
**Solution:** Flux then add solder.

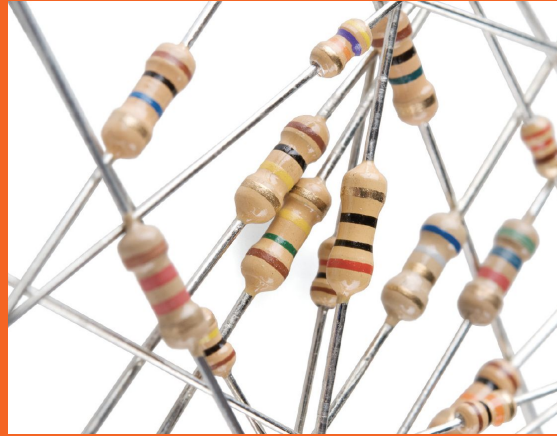
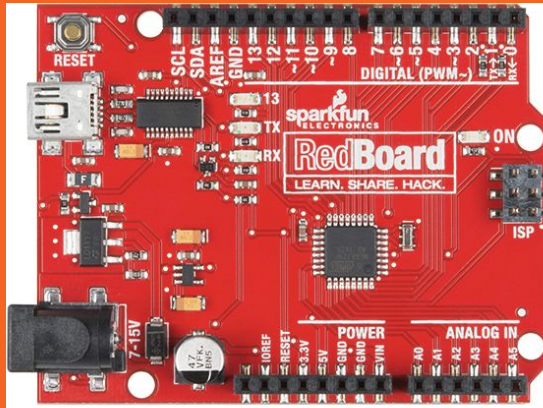


**E**

**Error:** Too much solder connecting adjacent legs (aka a solder jumper).  
**Solution:** Wick off excess solder.

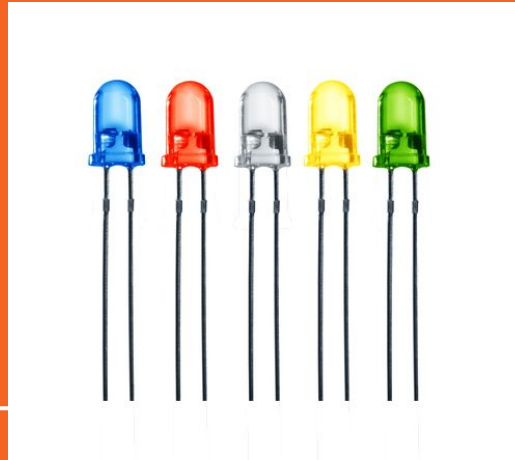
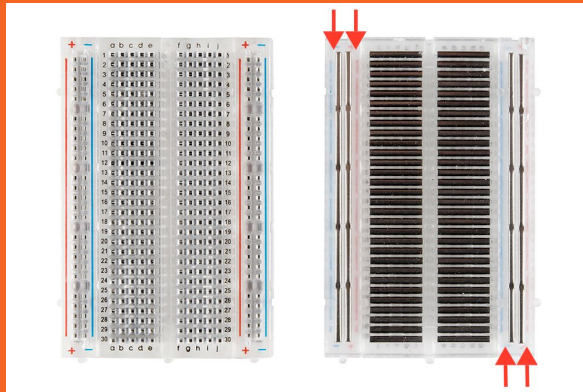






How are we  
going to  
connect?

Why do we  
need  
resistors?



Draw Diagram



# Take a minute to reflect.



## Tip

Write down whatever you want.

What did you learn today?

What do you hope to learn tomorrow?