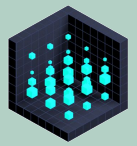
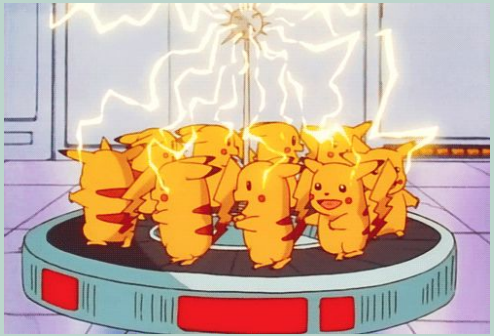


Electricity and Circuits

By Jocelyn Pern, Shakaani Nasankar,
and Danielle Aguiar



Electricity

I don’t get electricity jokes. Watts so funny about them?

“... the set of physical phenomena associated with the presence and motion of electric charge” (Wikipedia)

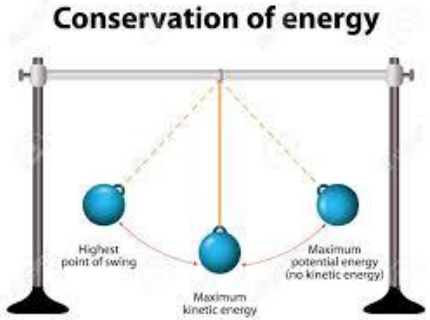
In other words…

A form of energy caused by charged particles

What does a light bulb eat for fresh breath?

The Energy Theory

The Conservation of Energy states that energy cannot be created or destroyed, only altered from one form to another.

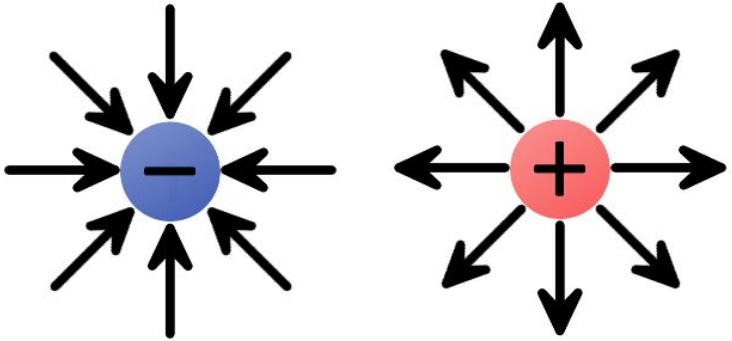


Fila-mint!

Positive vs. Negative Charge

Positive charge = lose electrons

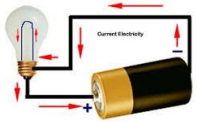
Negative charge = gain electrons



Static vs. Dynamic

Static - particles stay together

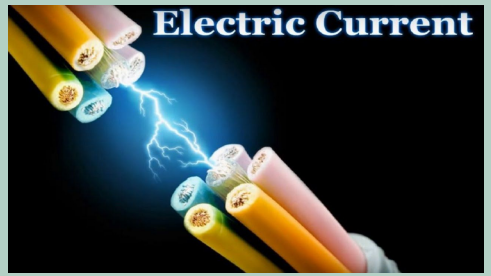
Dynamic - particles move in same direction



Voltage

vs.

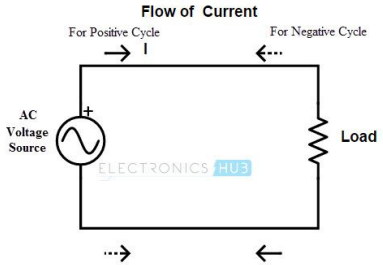
Current



voltage - measure of energy between two points

- supplied by a battery/power supply
- measured in Volts (V)
- can be measured using a voltmeter

VOLTAGE



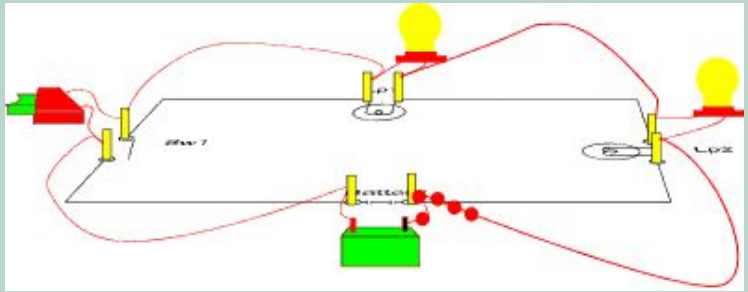
current - direction of the flow of charged particles

- flows from positive to negative potentials
- measured in Ampere (amp)

Direct and Alternating Currents

What's an electrician's favorite ice cream flavor?

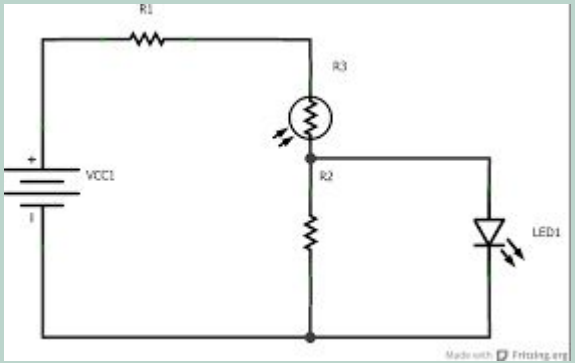
Circuits



circuit- a closed path where electricity flows where a battery is energy source

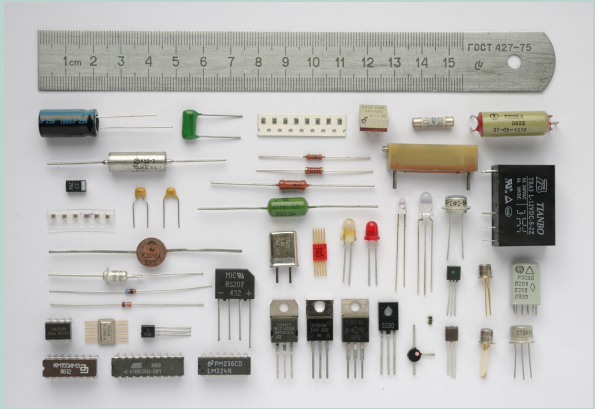
Shock-a-late

Schematic Diagram



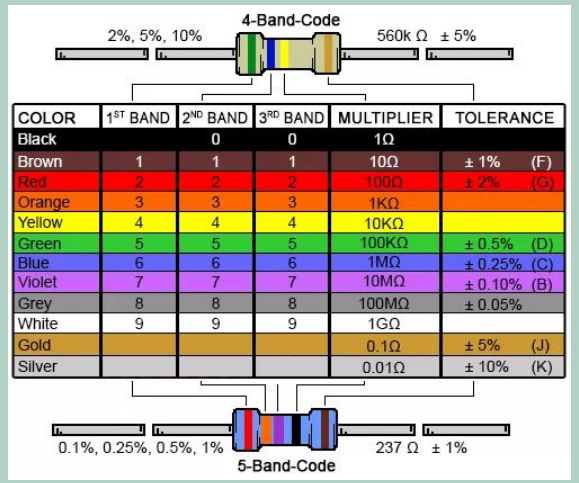
- shows the layout of a circuit
- uses symbols for the electrical components instead of realistic pictures
- shows current, voltage, and resistance
  - I = current
  - V = voltage
  - R = resistance

Circuit Components



- parts of a circuit
- loads (such as resistors, capacitors, and inductors)

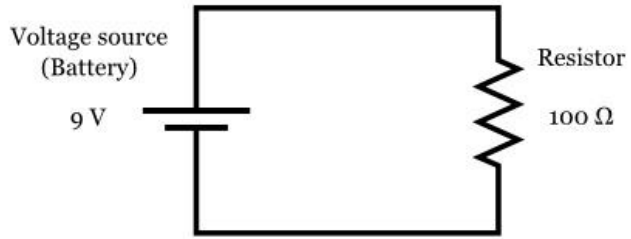
Resistors



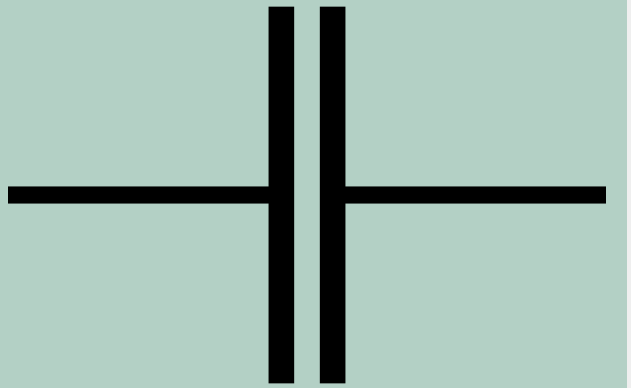
COLOR	1ST BAND	2ND BAND	3RD BAND	MULTIPLIER	TOLERANCE
Black		0	0	1Ω	
Brown	1	1	1	10Ω	± 1% (F)
Red	2	2	2	100Ω	± 2% (G)
Orange	3	3	3	1KΩ	
Yellow	4	4	4	10KΩ	
Green	5	5	5	100KΩ	± 0.5% (D)
Blue	6	6	6	1MΩ	± 0.25% (C)
Violet	7	7	7	10MΩ	± 0.10% (B)
Grey	8	8	8	100MΩ	± 0.05%
White	9	9	9	1GΩ	
Gold				0.1Ω	± 5% (J)
Silver				0.01Ω	± 10% (K)

resistors - controls the current flowing through a circuit

- less resistance = more current
- measured in Ohms (Ω)
- Related to Ohm's Law (V=IR)
- color strips around resistor tell the amount of resistance

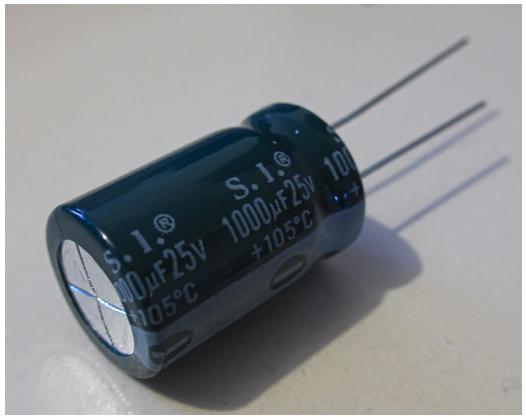


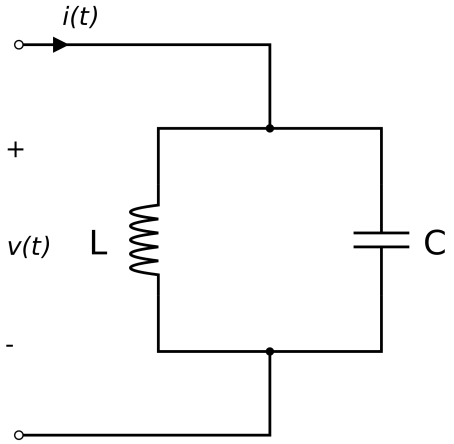
Capacitors



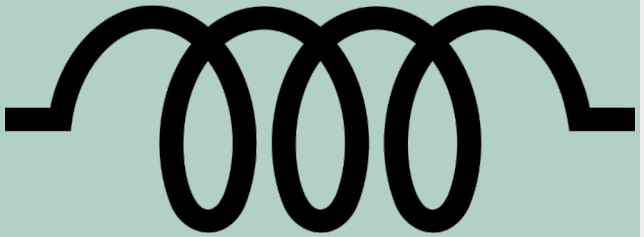
capacitors - two charged plates (positive and negative) that resist sudden shifts in the Voltage

- when fully charged, the current stops because it becomes an open circuit
- stores energy in an electric field

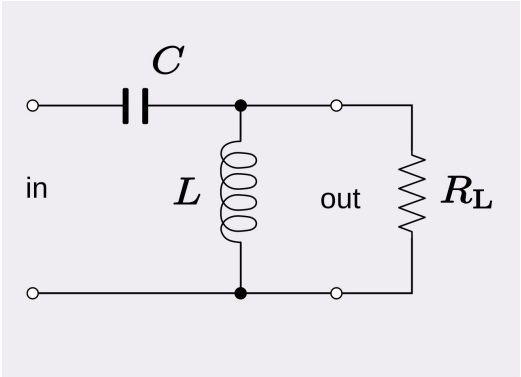




Inductors



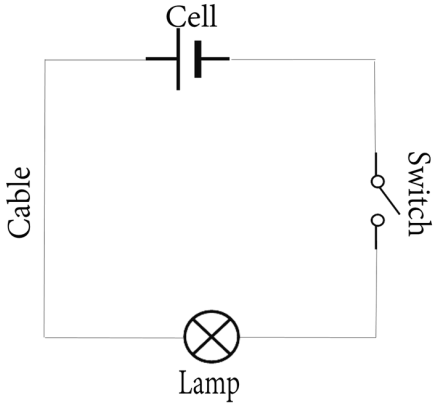
inductors - a coil that stores energy in the form of a magnetic field and resists sudden changes in the current



Switches

switch- a component that opens and closes

- can be used to open and close a circuit
- light switch- when you turn the light on, you close the circuit, vice versa



What kind of car does a electrician drive?

Circuit Properties

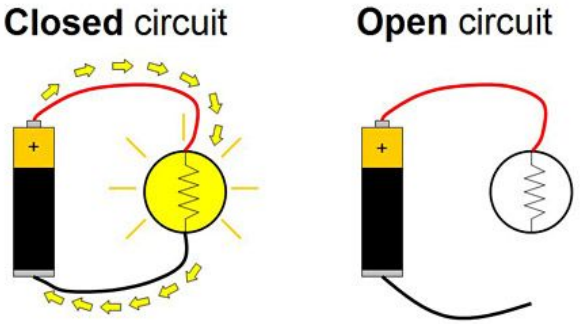
Volts-Wagon!!!

Open Circuit

vs.

Closed Circuit

- Open circuits do not allow an electrical current to flow through the circuit.
  - Air is not a good conductor, therefore the electricity cannot flow through to the next component or wire.



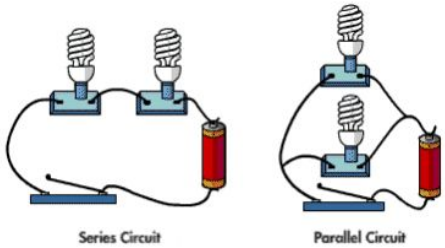
- Closed circuits are complete and allows electricity to flow through.

Series

vs.

Parallel

- In a series circuit, the electrical components share a current flow and have common nodes.

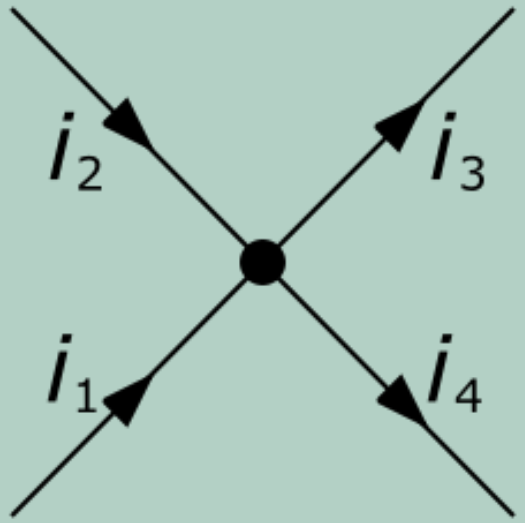


- In a parallel circuit, the electrical current splits paths and comes back to the negative terminal of the power source.

Kirchhoff’s Laws

- German physicist who created laws to calculate currents, voltages, and more
- also extended the theory of Georg Ohm

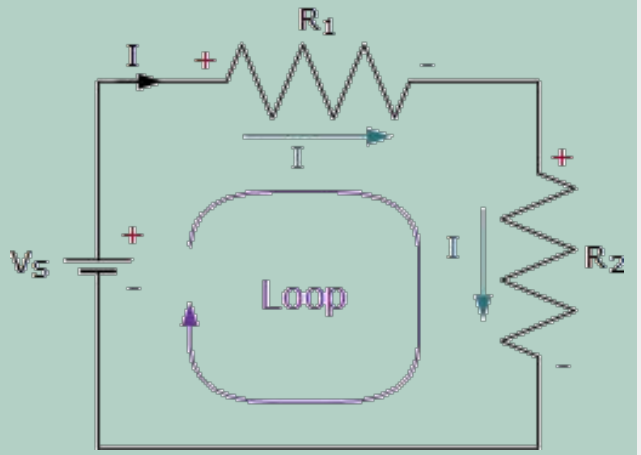
Kirchhoff's Current Law (KCL)



$$i_1 + i_2 = i_3 + i_4$$

- the sum of all currents entering a node is equal to the sum of those leaving
- based on conservation of charge
- also referred to as the junction rule
- can be used to solve for I, V, and R in a circuit with unknown quantities

Kirchhoff's Voltage Law (KVL)



- the sum of all voltage changes around a complete path is equal to 0
- based on the conservation of energy
- similar to displacement
- can be used to solve for I, V, and R in a circuit with unknown quantities
- also referred to as the loop rule

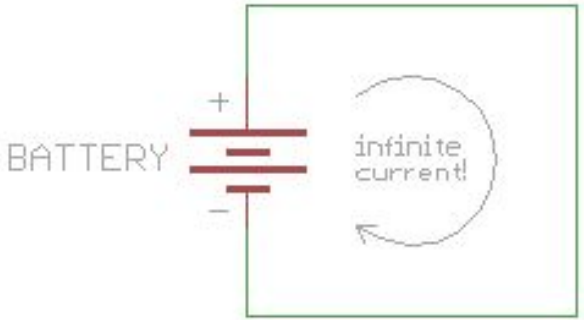
What do you call a detective electrician?

More About Circuits

Sherlock Ohms!

What is a Short Circuit?

A short circuit is when you connect a wire directly from the positive end to the negative end of the power supply. **DO NOT DO THIS!** This can cause explosions.



Circuits and Our Lives

Circuits are incorporated into our lives in many ways. They are used in nearly every type of item that uses electricity, from a phone to a lamp.

What did the baby light bulb say to the momma light bulb?

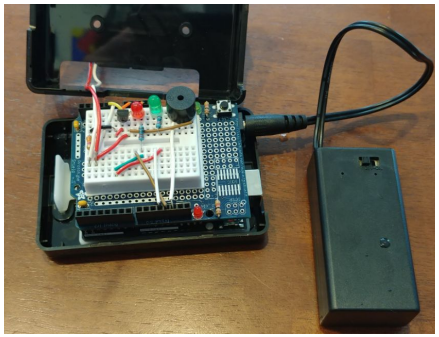
I love you watts and watts!

Example of a Circuit

```c
#include<stdio.h>
#include<conio.h>
void main()
{
int num,i,j;
printf("Enter a number below 100\n");
scanf("%d",&num);
for(j=1;j<=2;j++)
{
for(i=1;i<100;i++)
{
    printf("%d\n",i);
    if(i==num)
    break;
}
}
getch();
}
```

Another Example of a Circuit

Another example of a circuit is a device I built with a few of my classmates at school for a competition. It will alert the guardian of an child if it is too hot inside the car for the child via a buzzer and LED lights. This device uses a pressure sensor, a temperature sensor, and the alert system. It uses a battery as the power source.




QUESTIONS

Thank You!

Shoutout to Aixa, Catherine, Cynthia, and Dora for being wonderful coordinators and teachers, teaching us about computer science and engineering!