This simulation is available at: https://phet.colorado.edu/en/simulation/ohms-law

Ohm's Law PhET MiniLab

Introduction: When an electrical potential **(voltage)** exists in a circuit, a current may exist. Current is the flow of electrons in a circuit. Resistance in the circuit slows the flow of the electrons, reducing the current in the circuit. We will use the mathematical form of Ohm's Law frequently when we investigate electric current and circuits in this unit.

Additional Material Needed: Clean Plastic Straw (check your car's glovebox). Alternatively, you can roll up a piece of paper to the right diameter and use tape to make the straw.

Procedure:

· Blow through the drinking straw.
· Cut the drinking straw in half and blow through a half-straw.

1. Describe the effect of length on ease to blow air through the straw.

As the straw gets shorter, ___

· Cut the halves again in half.
· With the four pieces, blow through one, then blow through all four made into a larger, square-shaped straw.

2. Describe the effect of straw size (diameter) on ease to blow air through the straw.

As the straw gets wider, __

Go to:
https://phet.colorado.edu/sims/html/resistance-in-a-wire/latest/resistance-in-a-wire_en.html

3. As wire length increases, the resistance (Ω) ___

4. As wire thickness increases, the resistance (Ω) ___

Now go to:
https://phet.colorado.edu/sims/html/ohms-law/latest/ohms-law_en.html

5. mA (shown in simulation) is milliamps. Convert 1 Ampere to mA using KHD**B**dcm)

1A = _____ mA

Now convert 500 mA to A:

6. 500mA = _____ A.

· Move the potential (volts) and resistance (ohms) sliders and observe the current (amps), and answer the following questions based on the patterns you observe.

7. As voltage increases, current:

8. As resistance increases, current:

:

:

9. Fill out the tables below **and check your work in the simulation.**

- Remember, the simulation shows milliamps.
- **You should convert to Amperes**

The equation that represents Ohm's law is:**V = I *R** (The I is for Amps….stands for Impetus - latin…)

Volts = Amps of current * Ohms of resistance

Voltage is like electrical potential energy per charge

Electrical Potential (Volts) **V**	Current (amps) **I**	Resistance (Ohms) **R**	Work: **V = I* R**
8.0 V	**0.01A (this is 10mA)**	800 Ω	8V = 0.01 * 800
2.0 V	0.2A (this is 200mA)	**____Ω**	**2V = 0.2 * R** **Divide both sides by 0.2** **2/0.2 = ____**
__V	0.9 A (this is 900 mA)	10 Ω	V = 0.9A * 10 Ω
__V	0.5 A	10 Ω	
4 V	**__A**	20 Ω	

10. How many volts must an iPhone charger provide to charge an iPhone using 1 Amps at 0.2 Ω? (0.2 = ⅕):

11. You are hooking up a window air conditioning unit (recall, uses LOTS of energy) in your bedroom, but the cord isn't quite long enough to reach to the electrical outlet. You go to the store and are shopping for the best suited cord for your needs. What two factors (characteristics about different extension cords **related to this simulation**) would you look for?

The cord should be:

12. Find three electronic devices in your home that plug in to the wall.. Each will have a label somewhere that shows you their input power specifications. Some devices show both input and output if they are a power adapter. You are going to use a new equation, for Electric Power.

Power = Voltage * Current

Watts = Volts * Amps

Record information about the devices in the table below. If one of the components is unknown, use the equation to solve for it! I have given you a couple of examples to get started.

*Anything that is designed to plug in to the wall in North America is designed for 120V. Some devices can take 100 - 250V input, like laptop chargers. All your wall outlets are 120V though.

Name	Voltage (V)	Current (A)	Power (W)
15W fluorescent light bulb	120V	(I had to calculate!) P = I*V 15 = I * 120 Divide both sides by 120. 15/120 = 0.125 AMPS	15W
Hair Dryer	120V	1700 / 120 = ~ 14 AMPS - whoa that's a lot.	1700
Laptop Charger	(output) 19.5V	4.6 A	P = I*V P = 4.6 A * 19.5 **Rounding** P = 5 * 20 P = ~100W

Circuit LAB:
Go to:
https://phet.colorado.edu/sims/html/circuit-construction-kit-dc/latest/circuit-construction-kit-dc_en.html
Click on the LAB option.

Build a series circuit and a parallel circuit, and spend 5 minutes experimenting around with changing the wire connections, components, and resistances of the wires / lights / resistors, etc.
Afterward, answer the following questions:

13. What were the little blue things in the simulation representing?:

14. What happened if you did not have a complete path, or circuit?:

15. Compare a series and a parallel circuit. Which one would make your battery drain faster? Why?:

16. You probably accidentally made a short circuit at some point. This is defined as a circuit without enough resistance, where electricity can take a "short" path back to its source. *If you didn't make one yet, go ahead and do it now, just eliminate your resistors and light bulbs.* How did the simulation respond to a short circuit?:

17. Assuming you were holding this circuit together in your hands, how would you notice that you had

made a short circuit? (some of you did this on purpose when we made electromagnets):

18. Your house has a circuit breaker box to protect against short circuits, since short circuits can cause what dangerous and costly thing to happen?:

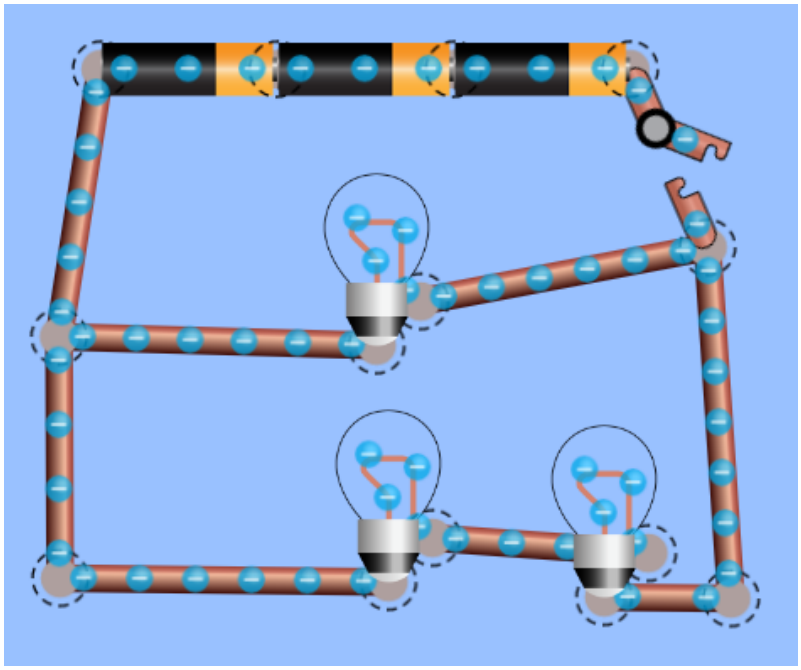
19. Build a simple circuit once more with a light bulb and a battery or two. Notice that you can change the resistance of the bulb by clicking once on it. What two things happen when resistance of the light bulb is decreased? (before it turns into a short circuit):

20. When the switch in the circuit below is closed, what will happen?
    a. What direction will the electrons move (clockwise vs counterclockwise)?:

    b. Which branch of the circuit (middle or bottom) will have the most current?:

    c. Which light bulb will be the brightest?:

    You may build this circuit to check your answers. (but try to predict first!)

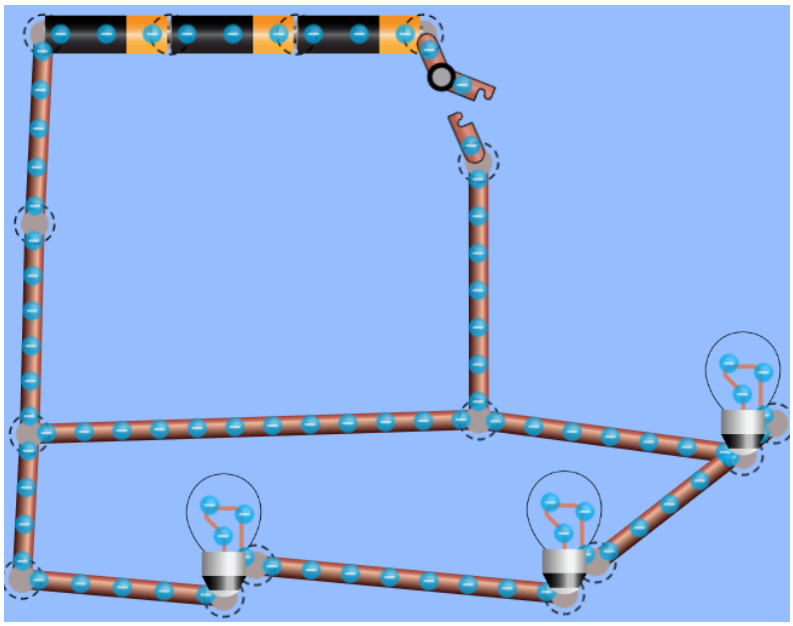


21. When the switch in the circuit below is closed, what will happen?
    a. What direction will the electrons move (clockwise vs counterclockwise)?:

    b. Which branch of the circuit (middle or bottom) will have the most current?:

    c. Which light bulb will be the brightest?:

    You may build this circuit to check your answers. (but try to predict first!)

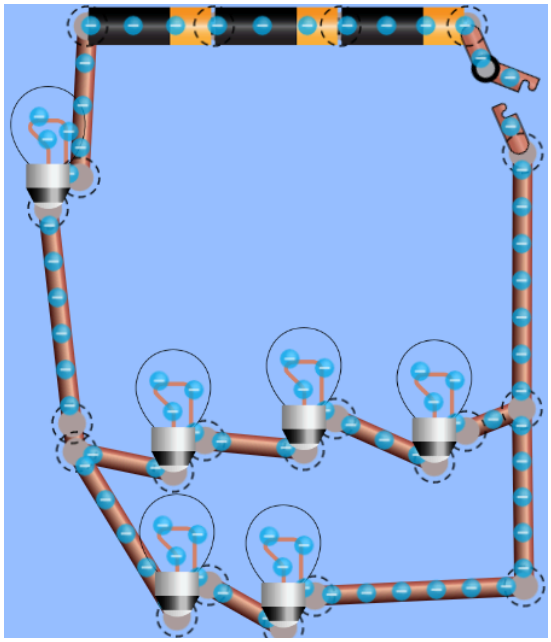


22. When the switch in the circuit below is closed, what will happen?
    a. Which branch of the circuit (middle or bottom) will have the most current?:

    b. Which light bulb(s) will be the Brightest?:

    c. Which light bulb(s) will be the Dimmest?:

    You may build this circuit to check your answers. (but try to predict first!)



23. When the switch in the circuit below is closed, what will happen?
    a. Which branch of the circuit (middle or bottom) will have the most current?:

b. Which light bulb(s) will be the Brightest?:

c. Which light bulb(s) will be the Dimmest?:

BUILD this circuit or one like it.

d. Click on the wire in the middle and increase its resistance a little bit.
   Is there some current in both branches of the circuit:?:

e. There is a common saying for this; Electricity takes the path of: :

I hope this virtual lab was helpful in getting you to learn about direct current, Ohm's law, and power. Next time we'll learn about alternating current and MAKING electricity.