Engineering

Basic Electricity Concepts

April 9, 2020

9-12/ Engineering

Basic Electricity Concepts: [April 9, 2020]

Objective/Learning Targets:

1. Discuss basic electricity relationships
2. Analyze the differences between real circuits and the simulated ones
3. Build circuits from schematic drawings

Basic Electricity Concepts

Electrical Circuit

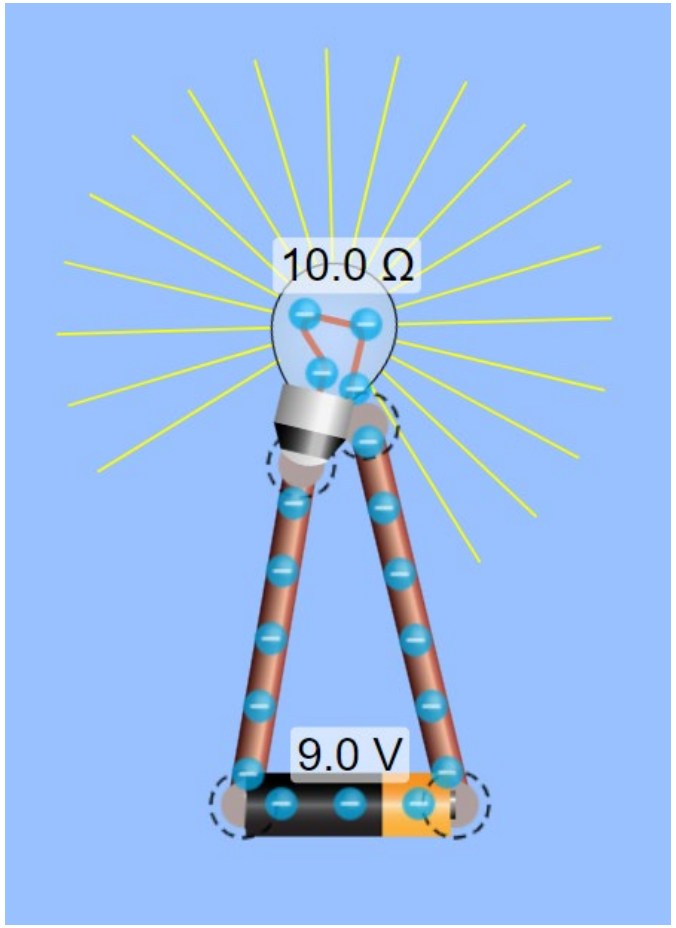
A system of conductors and components forming a complete path for current to travel

Properties of an electrical circuit

Concept	Measurement	Symbol	Formula
Voltage	Volts	V	V
Current	Amperes	A	I
Resistance	Ohms	Ω	R

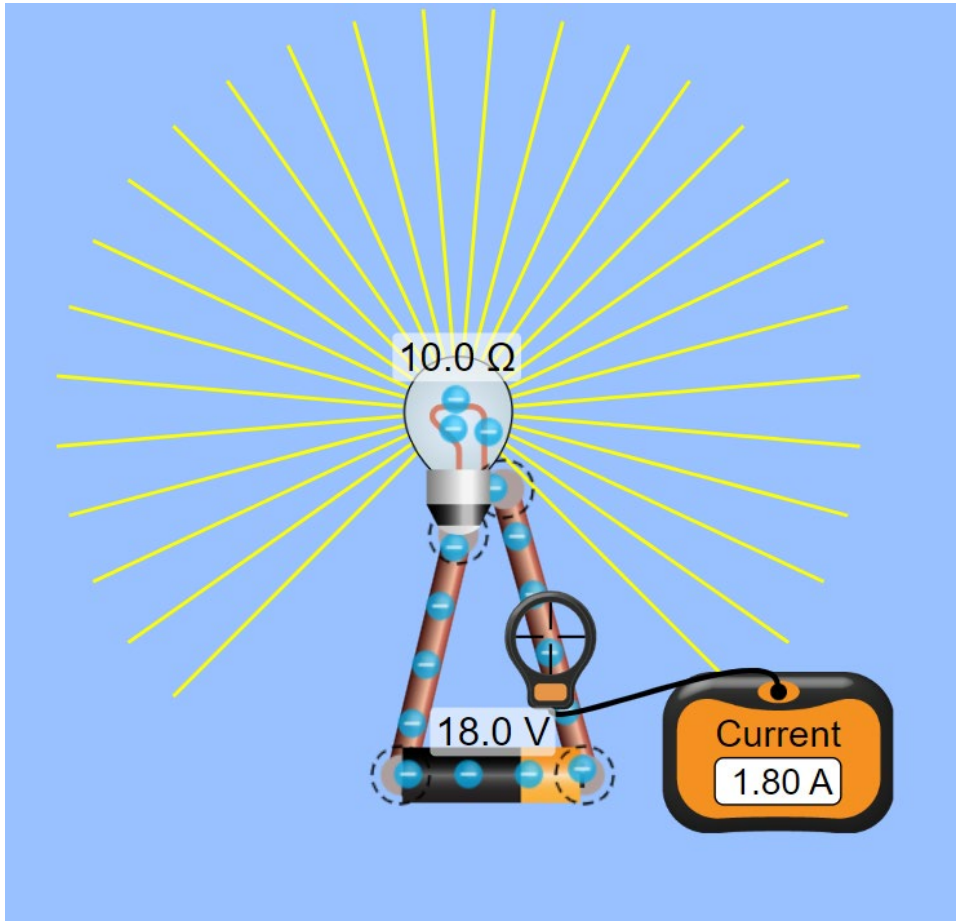
Current

- The flow of electric charge
  - Measured in Amperes (A)
- See Current in Action HERE
- Use this link and press play to enter a free simulator.
- Select intro and build this simple series circuit. You need a battery, a light bulb, and 2 wires. Click the selection in the top right for labels and values.



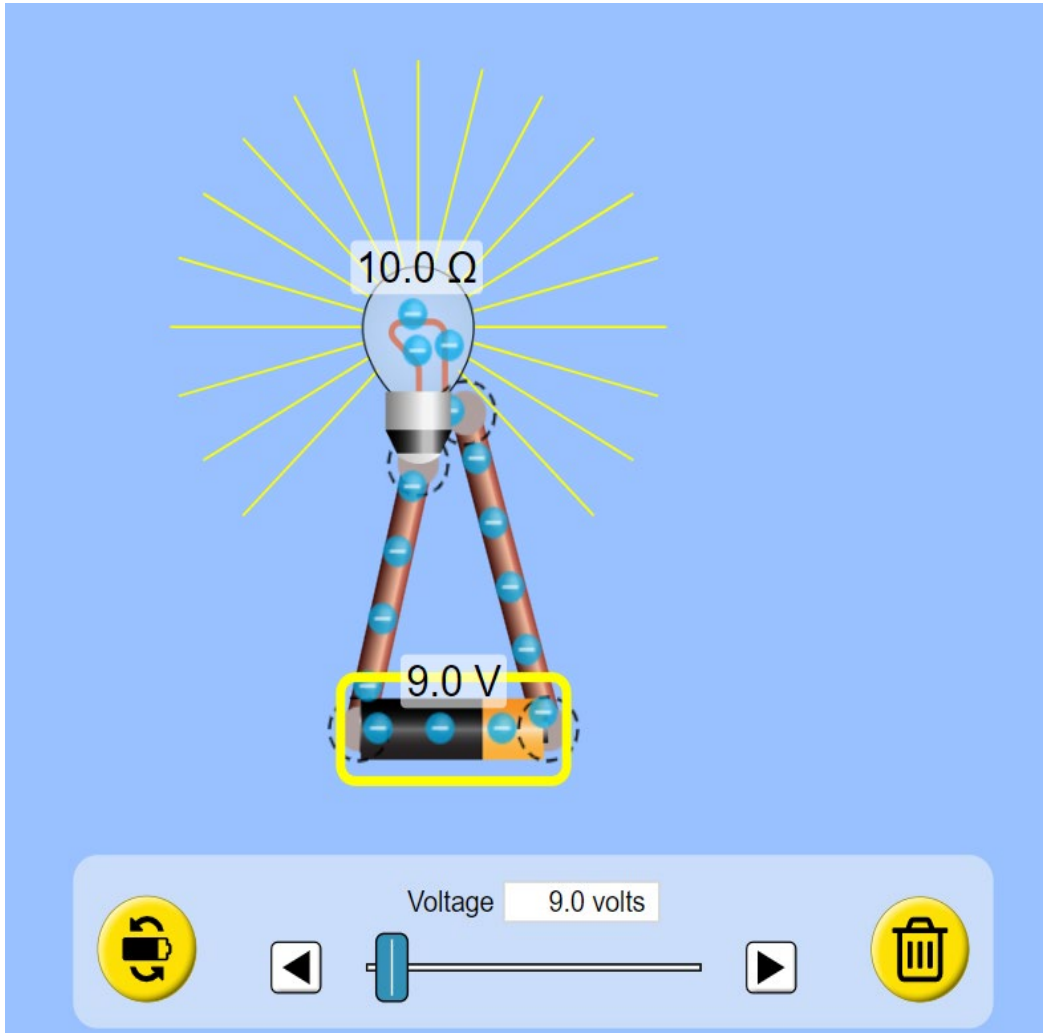
Simulator

- A simulation is a computer program that mimics real life to test potential results. The simulator we are using is very basic but allows you to do testing to understand the concepts.
- Add the Ammeter to the circuit to take a current reading of the circuit.
- Change the voltage to see the current also change.
- What do you observe about the relationship between current and voltage?



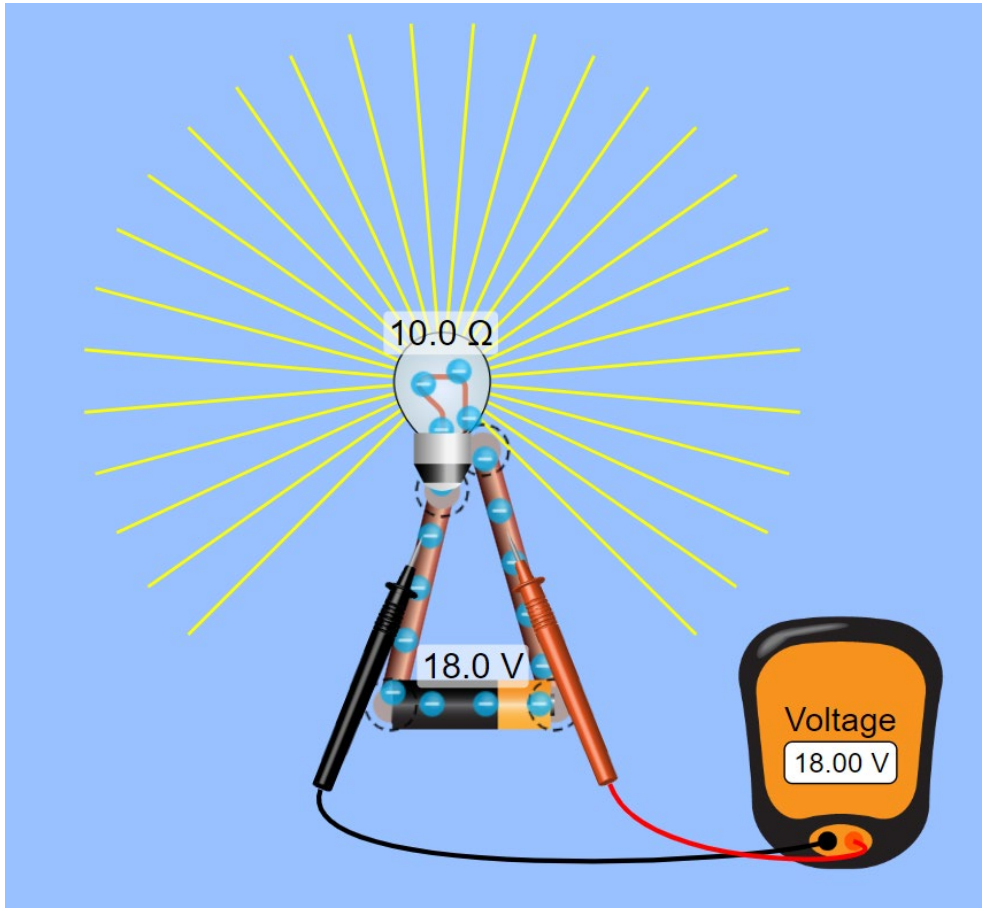
Current

- Use this link and press play to enter a free simulator.
- Increase the voltage of the battery by clicking the battery and adjusting the slider.
- What did you observe?
- How does that relate to the video you watched?
- How does the light bulb respond?
- What about the electrons?



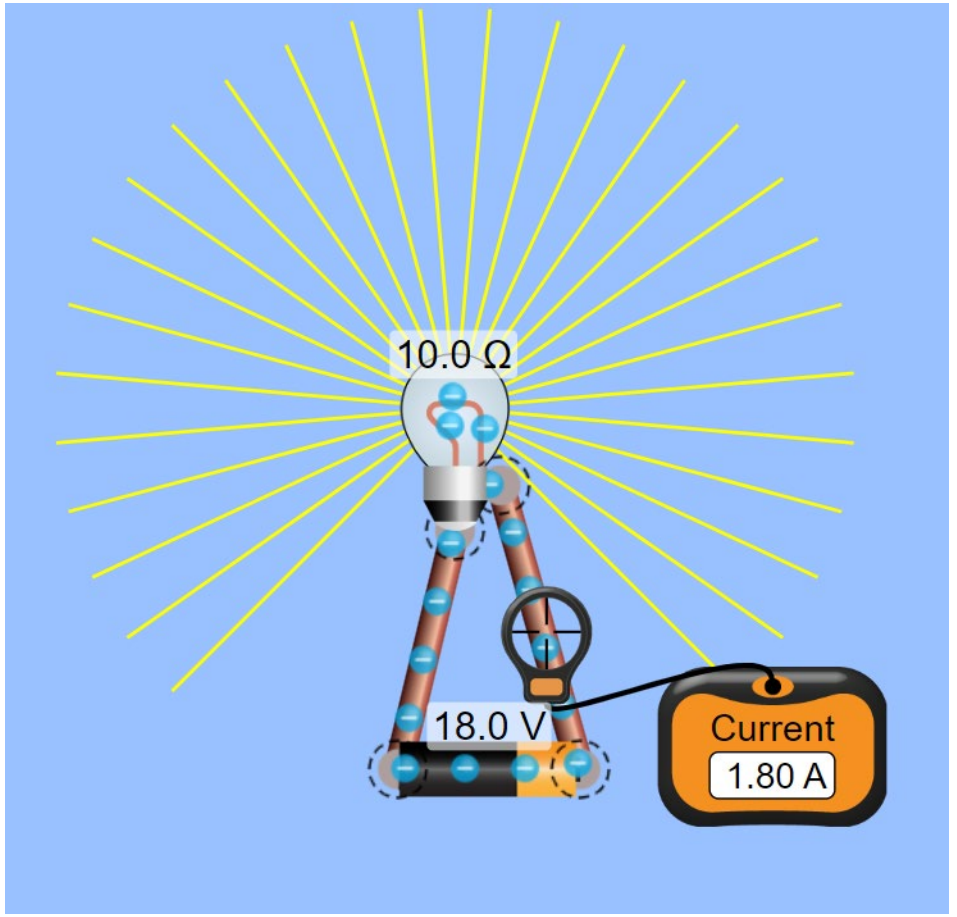
Voltage

- The force (pressure)that causes current to flow
  - Measured in Volts (V)
- See Voltage in Action HERE
- Place the mustimeter into the simulation
- Do the measurements match the circuit values?
- What happens if you reverse your leads?



Resistance

- The opposition of current flow
  - Measured in Ohms (Ω)
  - Resistance slows current down
- See Ohm's Law in Action HERE
- Set the circuit up this way and change the value of the lightbulb.
- What do you observe?
- What do the measurements show?
- Can you make the circuit catch on fire?



Relationships of Electrical Properties

Ohm's Law

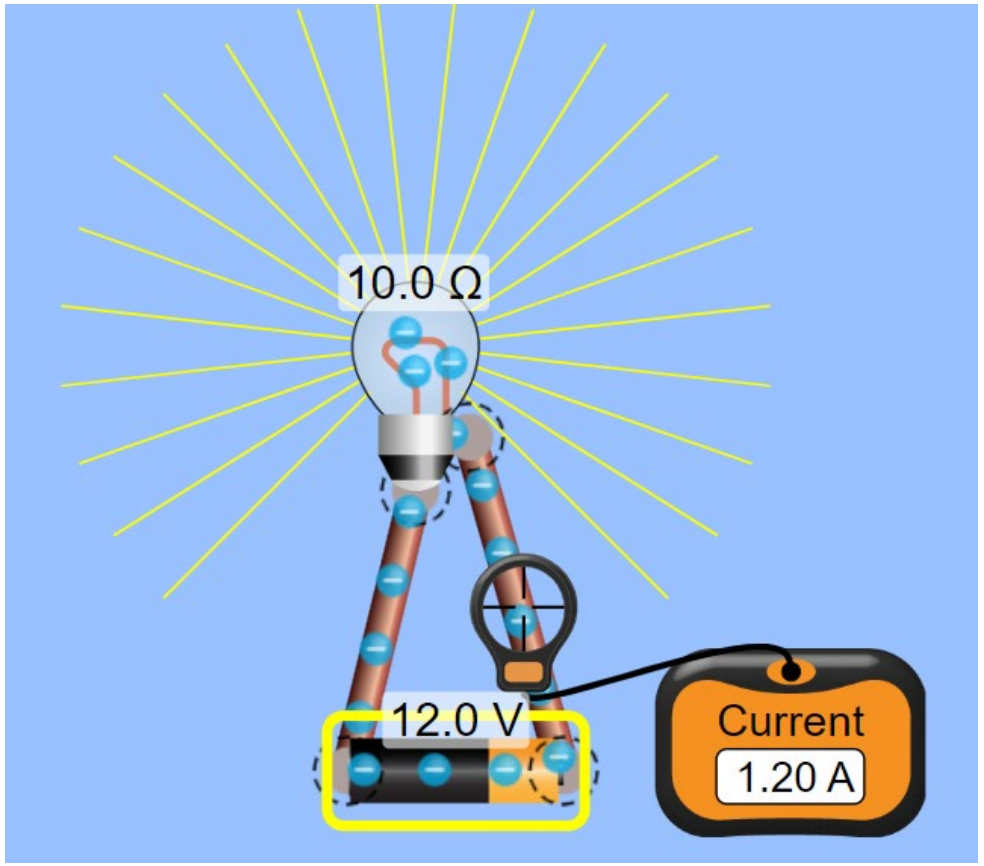
- Ohm's Law is the mathematical relationship between current, voltage, and resistance.
- If you know two of the three quantities, you can solve for the third quantity.

V=IR	I=V/R	R=V/I

Concept	Measurement	Symbol	Formula
Voltage	Volts	V	V
Current	Amperes	A	I
Resistance	Ohms	Ω	R

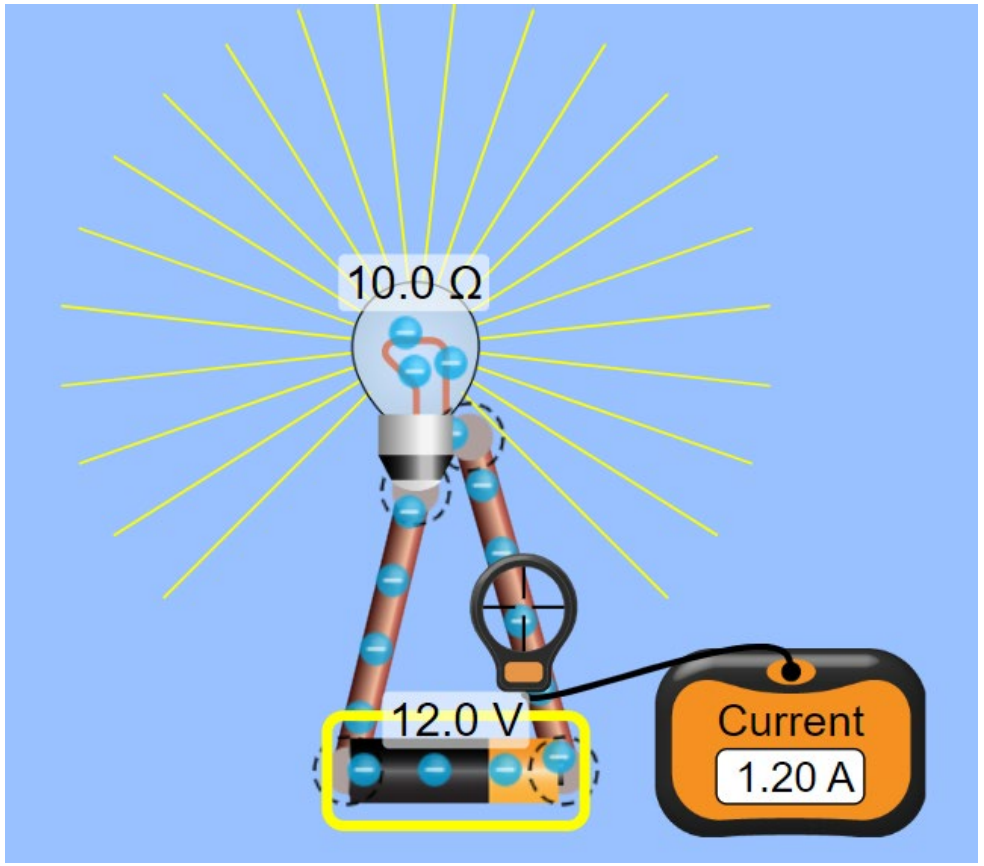
Ohm's Law

- Lets solve for the circuit to the left assuming we do not know the voltage.
- $V = IR$
- $V = 1.2A$ *10Ω
- $V = 12V$



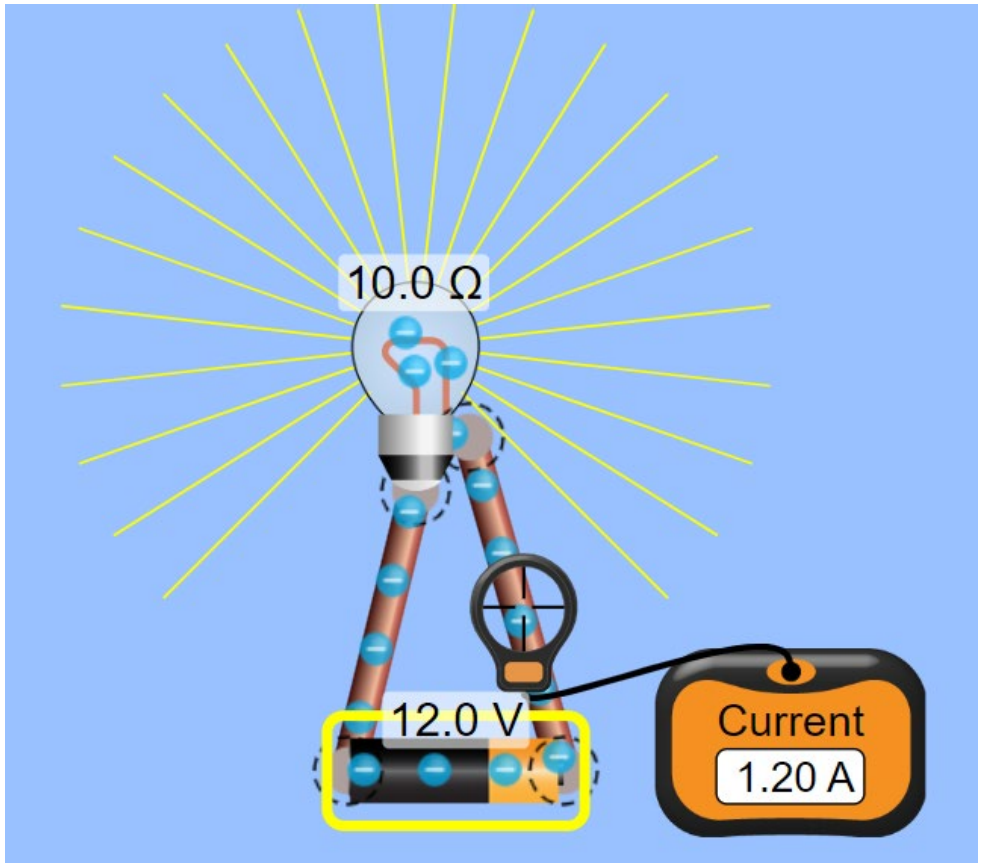
Ohm's Law

- Your Turn
- Solve for current and resistance
- $I = V \div R$
- $R = V \div I$



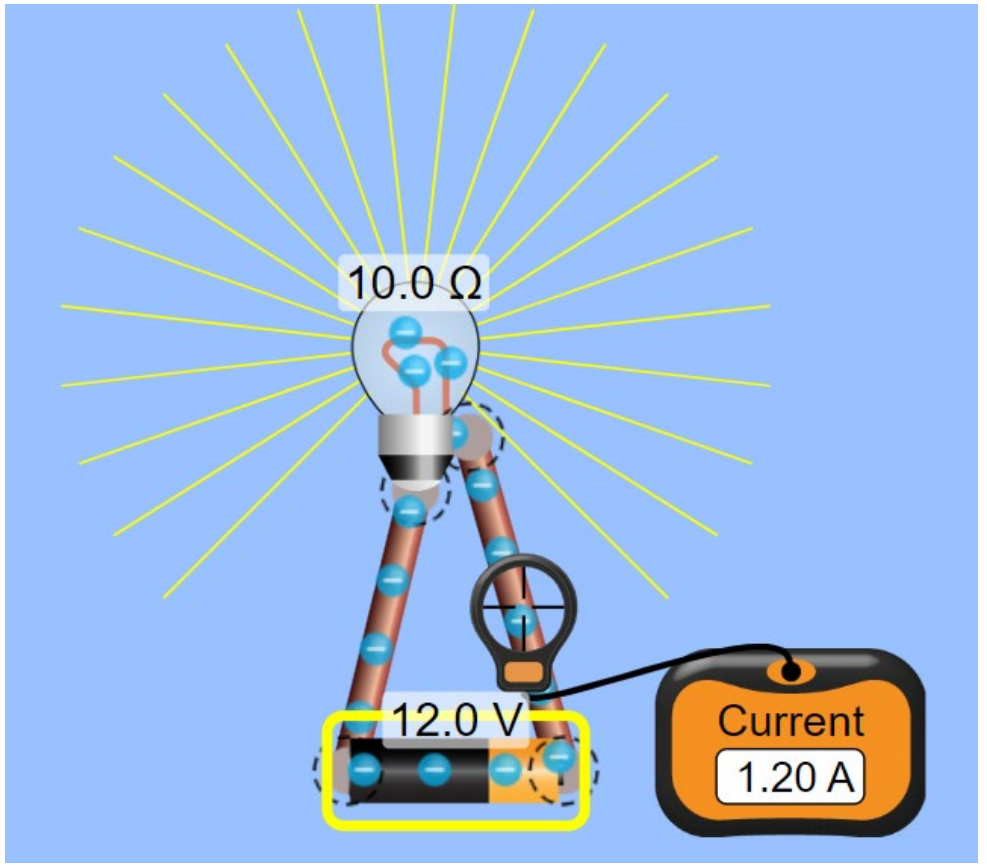
Ohm's Law

- Your Turn
- Solve for current
- $I = V \div R$
- $I = 12V \div 10\Omega$
- $I = 1.2A$



Ohm's Law

- Your Turn
- Solve for Resistance
- $R = V \div I$
- $R = 12V \div 1.2\ A$
- $R = 10\Omega$
- Now that you have the hang of it complete the practice problems. Attached



1. 5,700 Volts = _____K Volts = _____M Volts
2. 11 m Amp = _____A = _____u Amps
3. 2.5 Amps = _____m Amps = _____n Amps
4. 15 p Amps = _____u Amps = _____m Amps
5. .002 m Amps = _____Amps = _____u Amps

1. Using Ohm's Law, find V (in volts) when I = 1.25 x 10^{-3} A and R = 2 x 10^{3} Ω.
2. Using Ohm's Law, find R in kilohms when V = 12 V and I = 25 x 10^{-6} A.

The voltage across a resistor increases from 4.9 volts to 5.6 volts when the current is increased. What is the percent of increase in the voltage?

- Draw the CIRCUIT using computer simulation software.
- Show your MATH in the space provided.
- Label your answer.

1. A circuit has an applied voltage of 10 volts, and a resistance of 1,500 ohms. What is the current flowing in the circuit?

Calculations

V = _____
R = _____
I = _____

Circuit

Answer:_____

2. A circuit which contains 100 Kohms resistance has a current of 12 amperes. What is the applied voltage?

Calculations

V = _____
R = _____
I = _____

Circuit

Answer: _____

3. A circuit which contains 760 ohms resistance has a current flow of 20 ma. What is the applied emf - voltage?

Calculations

V = _____
R = _____
I = _____

Circuit

Answer: _____

4. A circuit has an applied voltage of 15 volts which causes 50 mA. of current to flow. What is the circuit's resistance?

Calculations

E = _____
R = _____
I = _____

Circuit

Answer: _____

5. An applied voltage of 10 volts causes a current of 5 uA to flow in the circuit. What is the total resistance in the circuit?

Calculations

E = _____
R = _____
I = _____

Circuit

Answer: _____

1. A circuit has an applied voltage of 5 volts which causes 30 ma. of current to flow. What is the circuit's resistance? Use Ohm's Law to find the correct resistance. Apply the 5 volts to the resistance on your breadboard and test for current.

   Does the meter read 30ma?

2. A circuit has an applied voltage of 5 volts across a 360-ohm resistor. What is the circuit's current flow? Use Ohm's Law to find the correct current. Apply the 5 volts to the resistance on your breadboard and test for current.

   Does the meter read the value you found using Ohm's Law?

Conclusion

1) What are the circuit breakers in your house rated at? What do the breakers do?