

How to Use a Multi-Meter

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Multi-Meter is an instrument designed to measure electric current, voltage, and usually resistance, typically over several ranges of value.



Dial turn to desired Electrical unit and measurement range

Red Lead: Plug into 10AMAX
NOTE: This is a fuse is ONLY used when measuring Amperage

Red Lead: Plug into VΩhmA
NOTE: This is a fuse is ONLY used when measuring Voltage or Resistance

Black Lead: Plug into COM
This will Ground the circuit

Measurement Basics

Voltage: Leads are placed in parallel with the item being measured.

- Red Lead to Positive (+)
 - Black Lead to Negative (-)
- NOTE: If leads are reversed the reading may come back negative.

Resistance (Ohms): Measurements are made without a power source. Note: Individual component may need to remove from circuit.

NOTE: Because there is no electrical load on the circuit the placement of the leads does not matter.

Amps: Leads are placed in series with the device being measured.

Safety

1. Before making Measurements SET the Multi-meter range and Red Lead to proper Setting
2. DO NOT quickly switch back and forth between Amps and Volts WITHOUT changing the meter reads
 - a. Result could be the following
 - i. Breaking the Fuse in the Multi-Meter making it useless
 - ii. Damage Electrical Components
 - iii. Creating an Arc of Electricity between Red and Black Leads causing dangerous electrical shock or causing a fire.

Error Display

NOTE: if the display shows a 1 (as shown below) then there is an error is measuring.

Issues could be the following

- Multi-Meter setting is out of range
- Electrical wires are connected forming a circuit
- Electrical Components are bad



Voltage: Testing a battery

Settings

Voltage Range: Each setting will measure up to the stated value. (ie Setting 20 will measure from 0 to 20 volts). NOTE: Different settings will provide a different number of place holders (ie Setting 20 will give up to 20 Volts and measure as low as hundredth of a volt)

500: 0 to 500 Volts (no Decimal value)

200: 0.0 to 200.0 Volts (lower limit display: measure to tenths place)

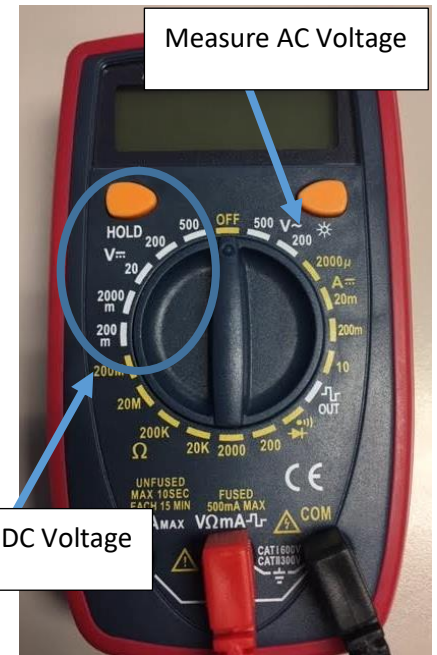
20: 0.00 to 20.00 (lower limit display: measure to hundredths place)

2000m: .000 to .999 (measure is millivolts; note decimal will not be displayed)

200m: 0 to .2 (measure is millivolts; reads 20.0)

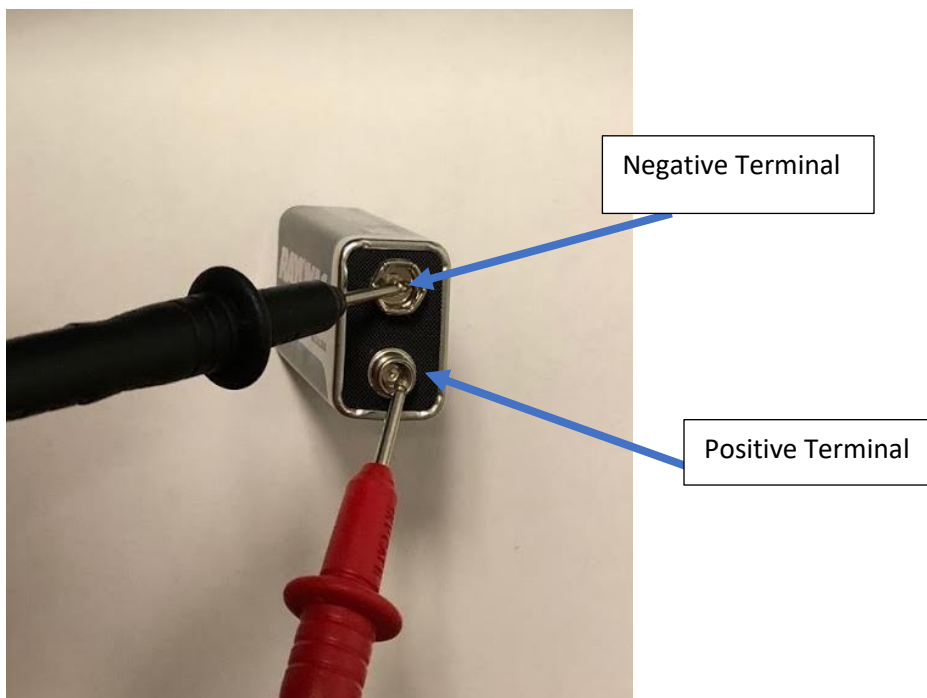
Display

- upper limit: tens place (max 20)
- lower limit display: tenths place



ATTENTION
RED LEAD: Place in
VOHMA Port

1. Have the following batteries available and record your results on the Multi-Meter Worksheet
 - a. 9 Volt
 - b. AA
 - c. AAA
2. Set the multi-meter to 20 Volts
3. Place the leads as shown

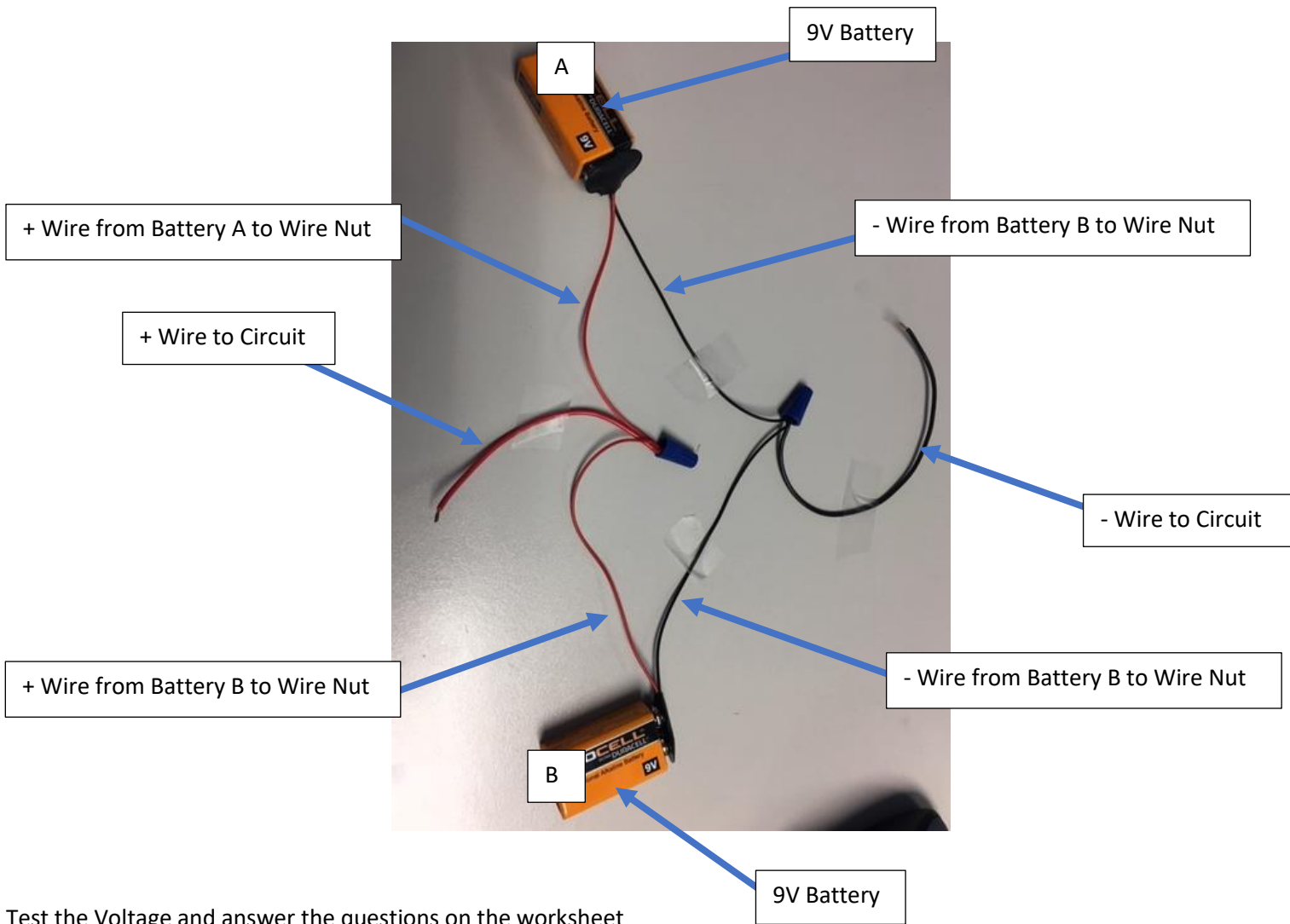


4. Measure the voltage and record on the worksheet
5. Switch the Red and Black Lead on the battery terminal. What happens?
6. Create the following wiring harness

Materials

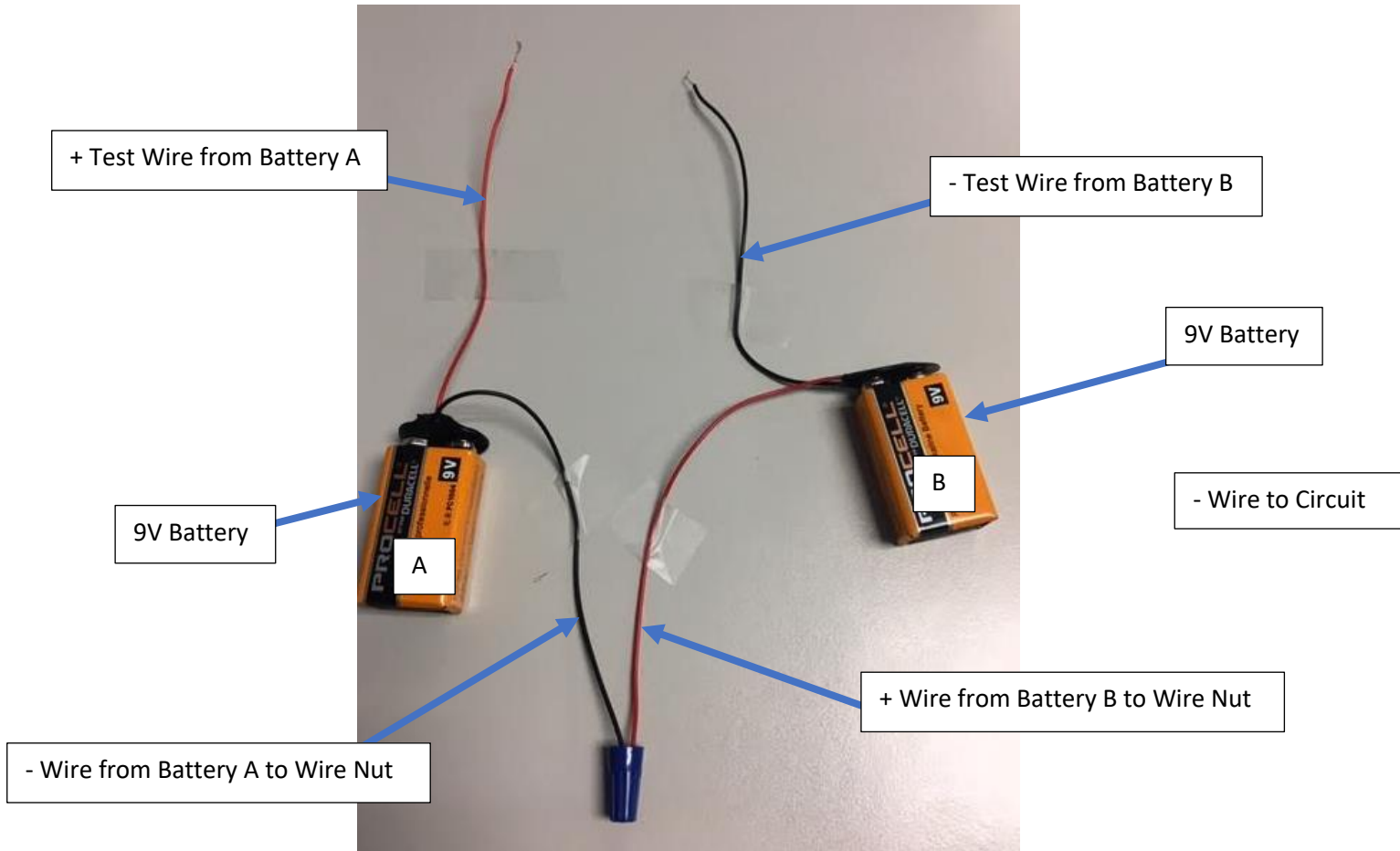
- 2: 9 Volt Batteries
- 2: 9 Volt Wire Adapter
- 2: Wire Nuts
- 1: about 2" long 20 gauge RED wire w/ both ends stripped
- 1: about 2" long 20 gauge BLACK wire w/ both ends stripped
- 2: Alligator Clips

Wire Setup 1



Test the Voltage and answer the questions on the worksheet

Wire Setup 2



Test the Voltage and answer the questions on the worksheet

Resistance: Testing Resistor and Photoresistor

Settings

Resistance Range: Each setting will measure up to the stated value. (ie Setting 200 will measure from 0 to 200 Ohms). NOTE: Different settings will provide a different number of place holders (ie Setting 200 will give up to 200 Ohms and measure as low as hundredth of a volt)

200: 0 to 200 Ohms

2000: 0 to 2000 Ohms

20K: 0 to 2000 Ohms

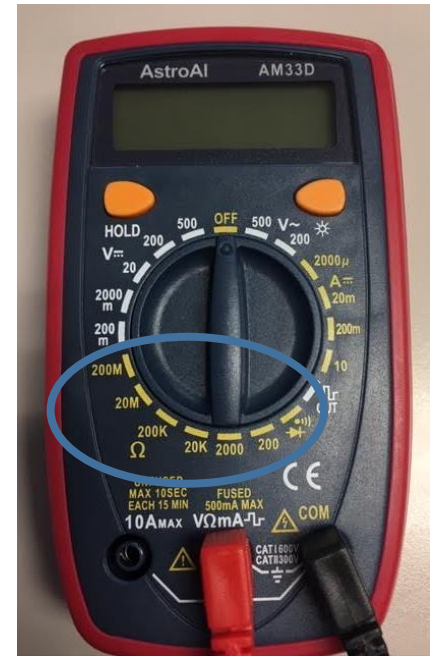
200K: 0 to 20,000 Ohms

20M: 0 to 20,000,000 Ohms

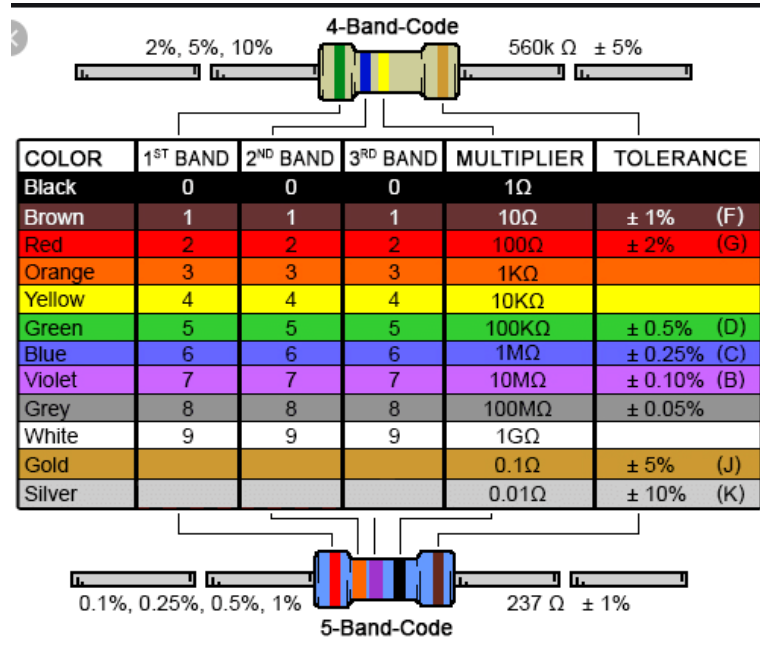
200M: 0 to 200,000,000 Ohms



: Symbol represents a variable resistor reading. It is not restrictive like the other settings



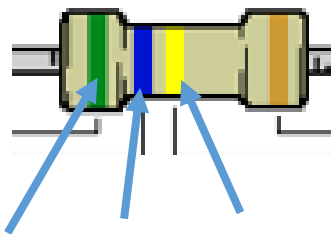
2. Resistor Colors



Sizing a Resistor

- Orienting the Resistor the correct way to read it > place the fourth color, which will be silver or gold to the right. This band represents the tolerance on the resistor Gold +/-5% and Silver +/-10%
- First band represents the tens place
- Second Color Band represents the singles place
- Third Color Band represents exponent value of ten

4- Band Resistor



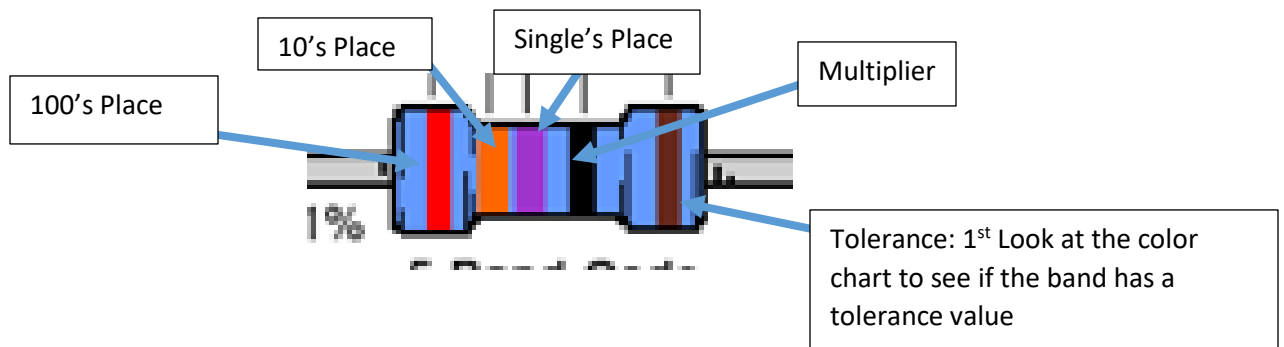
$$5 \quad 6 \times 10^4$$

OR

$$560,000 = 56K\Omega \text{ w/Tolerance } \pm 5\%$$

Making the resistor range 53.2KΩ to 58.8KΩ

5- Band Resistor

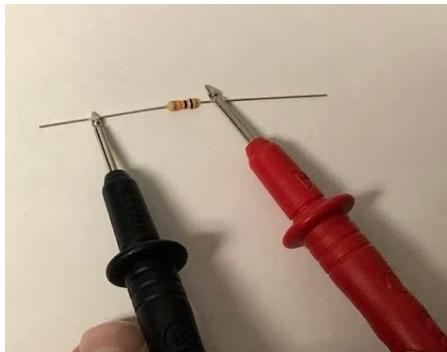


2 3 6 x 10⁰
OR
236 Ohm w/Tolerance +/-1%

Measuring a Resistor

NOTE: Resistors should be measured without electricity.

1. Set the Multi-Meter to Variable Setting
2. Place the resistor on the desk (may consider placing tape over the resistor to hold in place)
3. Place leads on either side of the resistor. NOTE: it does not matter which side the Red and Black Lead are on because when the resistor is installed it can be placed in either direction in relation to the flow of electricity and still operate.



Measuring Photoresistor

Definition: is a light-controlled Variable Resistor. (Also, known as a light-dependent resistor (LDR))



1. Set the Multi-Meter to Variable Setting
2. Place Photoresistor on desk similar to the fixed resistor above
3. Place the Red and Black Lead on the posts

Measuring Current

Settings

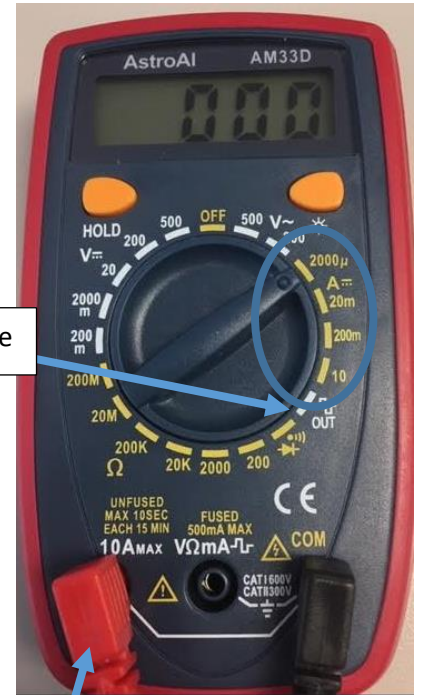
Resistance Range: Each setting will measure up to the stated value. (ie Setting 200 will measure from 0 to 200 Ohms). NOTE: Different settings will provide a different number of place holders (ie Setting 200 will give up to 200 Ohms and measure as low as hundredth of a volt)

2000 μ :

20m: 0 to 20 milliamps (.02 amp)

200m: 0 to 200 milliamps (.000002 amp)

10: 0 to 10 amps



Measure AC Amperage

Place Red Lead in the 10Amax Port

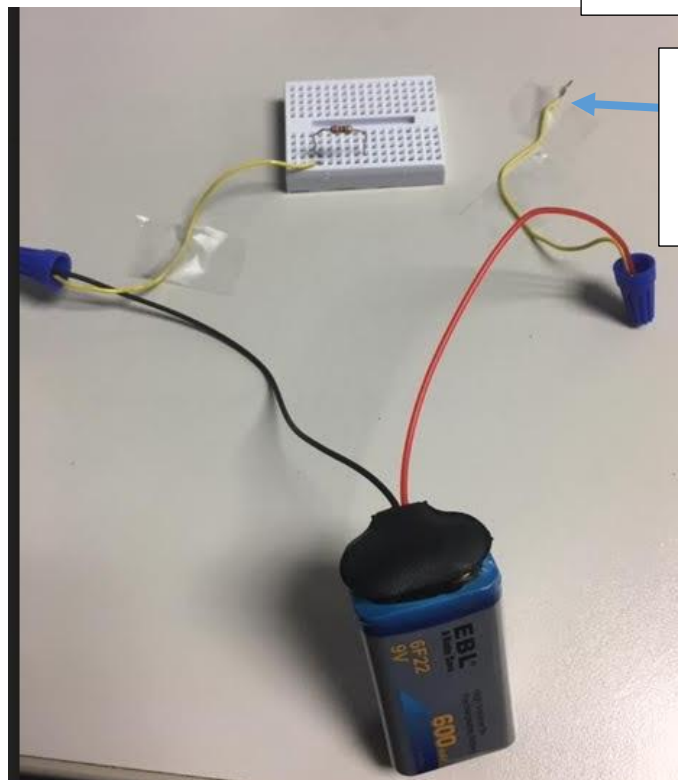
Measuring Amperage

Wire Circuit

Materials

- 1: 220 Ohm Resistor
- 1: 9 Volt Battery
- 1: Battery Harness
- 2: Loose Wires
- 2: Wire Nuts

Wire the circuit shown to the left



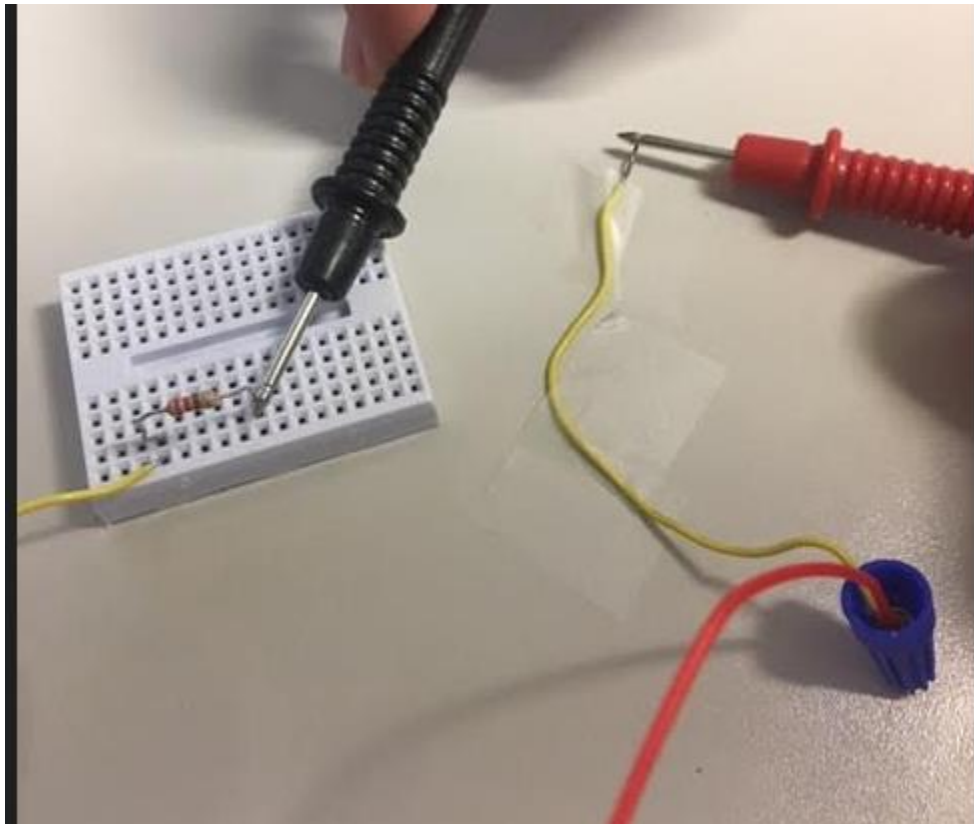
Leave the + Wire Disconnected from the circuit. The Multi-Meter will bridge this gap

Set Multi-Meter to 10 and Red Lead to 10Amax Port



Place probes in the following location

- Red Probe: Touch the Disconnected + Wire
- Black Probe: Touch the Resistor on the + Side



Hold the probes steady for a couple of seconds to get an accurate reading.

Series Circuit

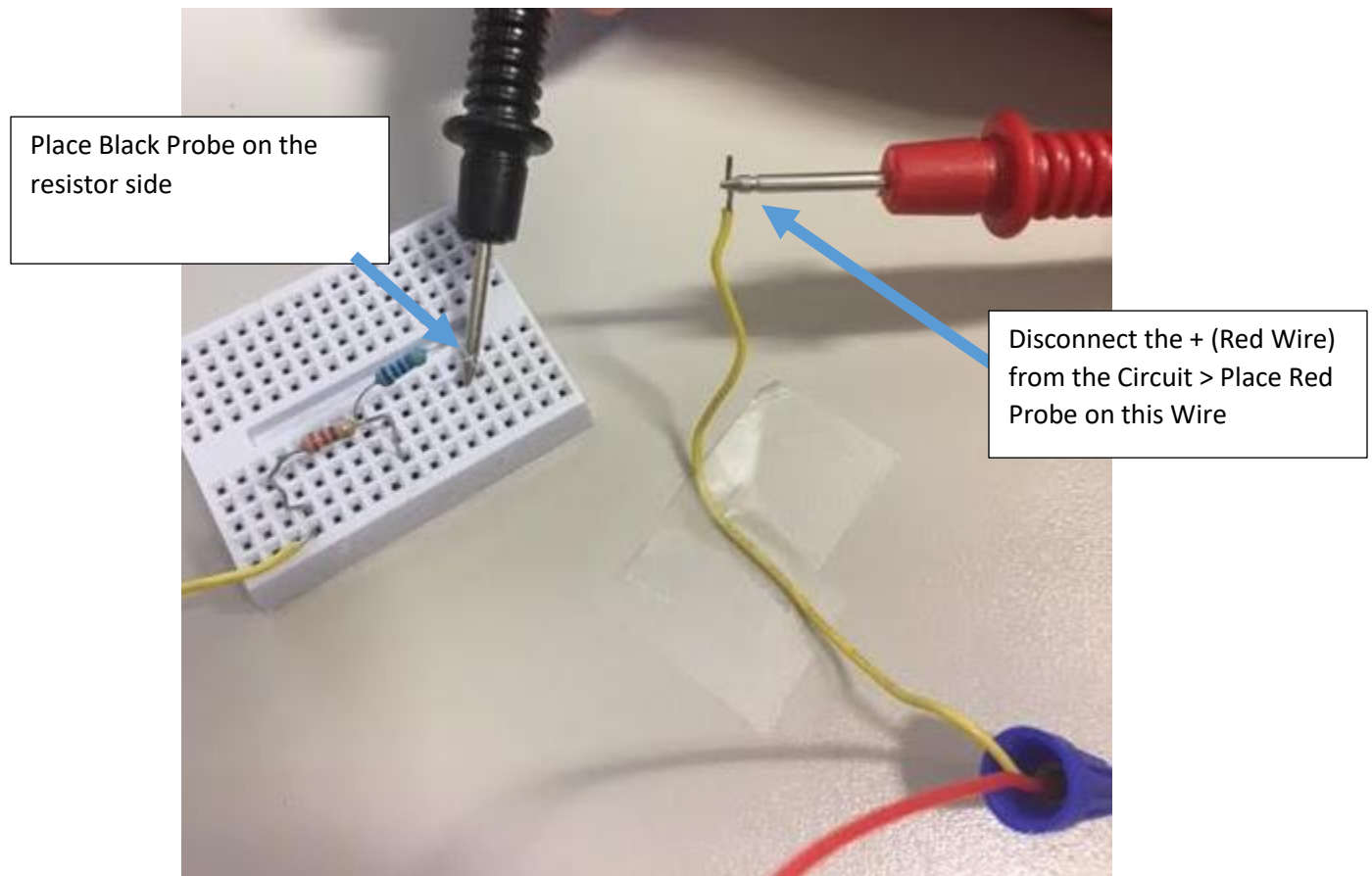
Add a 430 Ohm Resistor with the 220 Ohm Resistor as shown.



Place the Red and Black Probe as shown

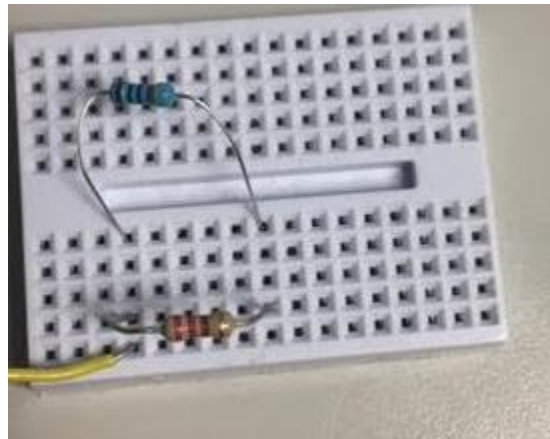
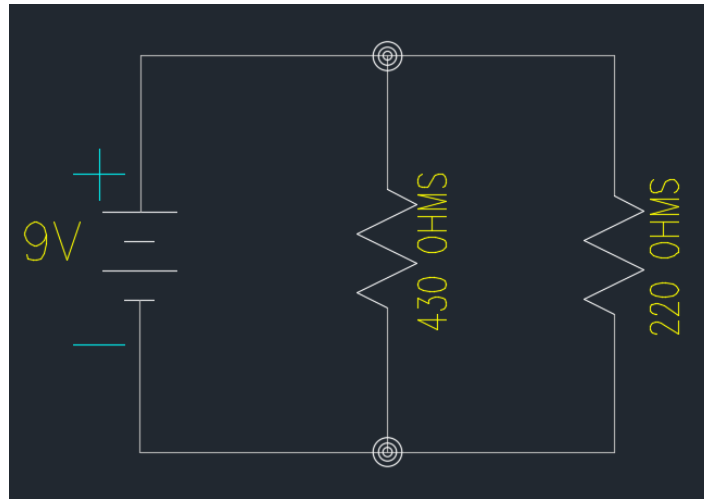
Adjust Multi-Meter for Amperage Setting. Choose a setting a see if you get an accurate value; adjust as needed.

Record your findings



Parallel Circuit

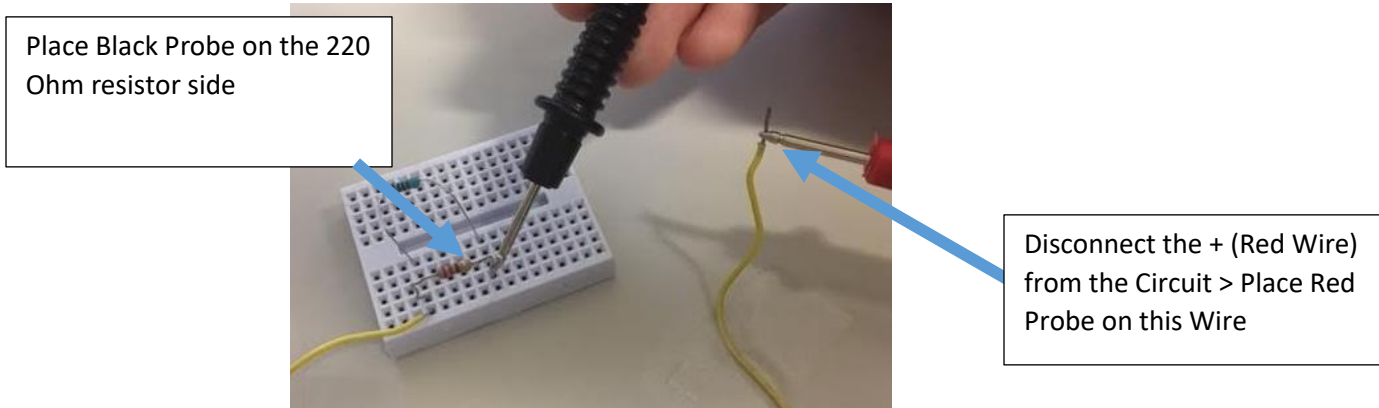
Reposition the 430 Ohm Resistor as shown



Measure each Resistor in the circuit as shown

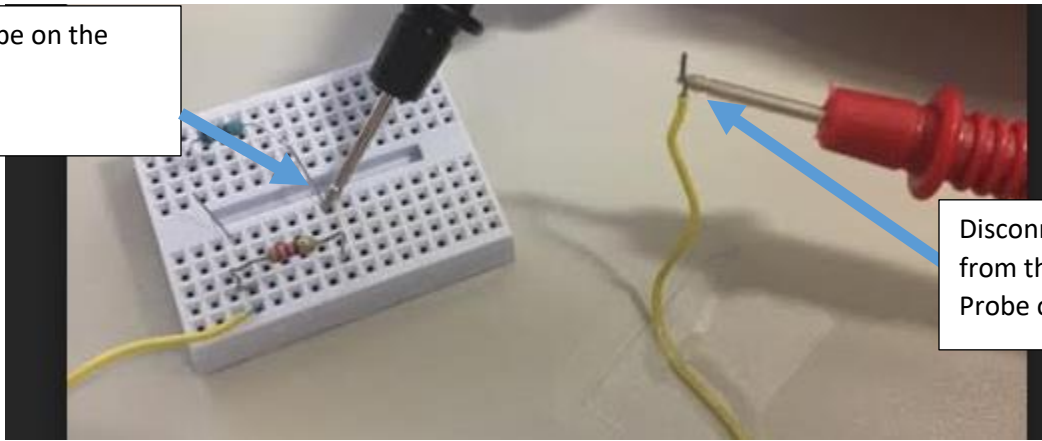
Adjust Multi-Meter for Amperage Setting. Choose a setting and see if you get an accurate value; adjust as needed

220 Ohm Resistor



430 Ohm Resistor

Place Black Probe on the resistor side



Disconnect the + (Red Wire) from the Circuit > Place Red Probe on this Wire

Record your findings