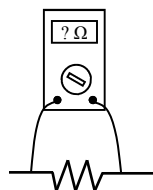# Series Circuit Lab

In a series circuit the electricity flow from one device to the next in order. There are no split points (junctions).
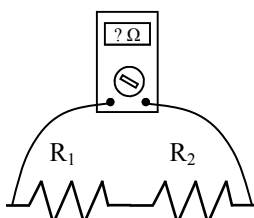
Part I—Resistors in series. (An Ohmmeter.)

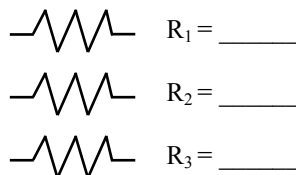1. Set your multimeter to read 2000 Ω (*see diagram at right*).

2. Using your ohmmeter to measure each of your three <u>different</u> resistors.   The resistor must be out of the circuit when you do this. DO NOT CONNECT THE BATTERIES TO THE RESISTORS!

3. Record your information here:

$R_1 =$ _____

$R_2 =$ _____

$R_3 =$ _____

4. Connect resistor 1 and 2 in your circuit board. Measure and record the total resistance. Make sure your probes go from one end to the other (*see diagram at left*).
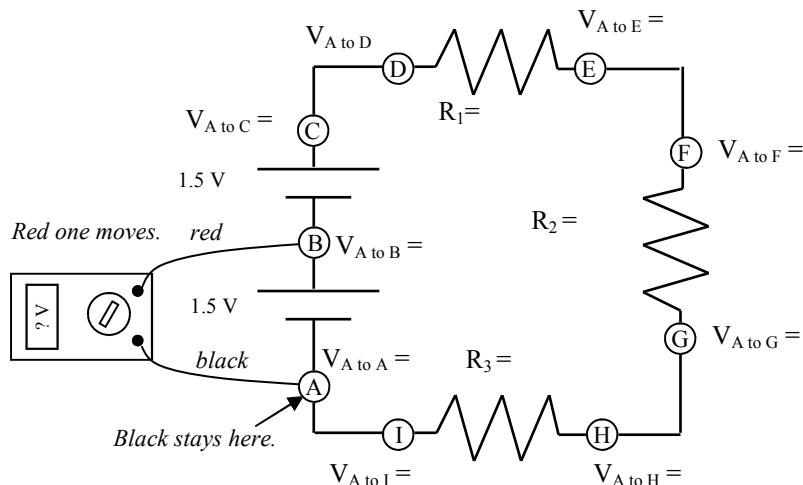
$R_{total} =$ _____

5. Using the same process measure and record the total resistance for all three resistors in series.

6. Using what you learned: *Four resistors are placed in series: 10 Ω, 100Ω, 25Ω and a 35Ω. What is the total resistance?*

R_1 R_2 R_3
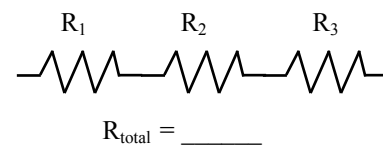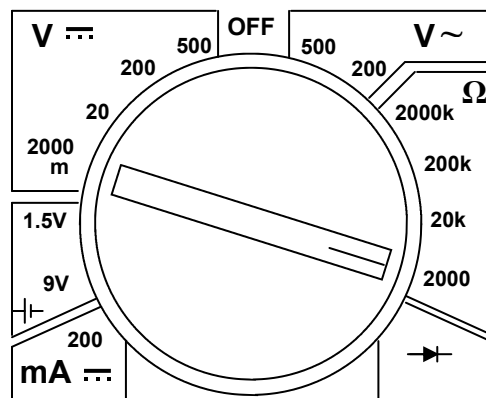
$R_{total} =$ _____

Part II—Voltage in a series circuit. (A Voltmeter.)

1. Set up the multimeter to measure 20V, as shown.

2. Using the same three resistors, make the circuit below. To save batteries, do not connect the final wire until you are ready to continue.

3. Label each of the resistors on the diagram with the resistances you measured in Task 1.

4. As shown, touch the negative probe (black) to point A (or whatever exposed conductor is on the negative side of the first battery).

$V_{A to D}$

$V_{A to E} =$

$V_{A to C} =$

$R_1=$

$V_{A to F} =$

1.5 V

Red one moves.   red

$R_2 =$

$V_{A to B} =$

1.5 V

black $V_{A to A} =$ $R_3 =$

$V_{A to G} =$

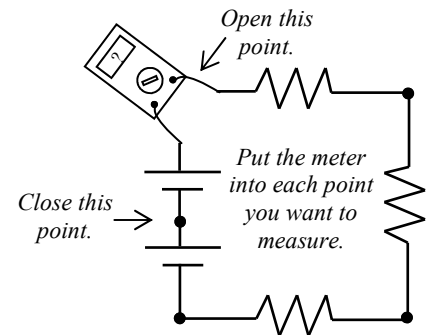*Black stays here.*

$V_{A to I} =$ $V_{A to H} =$

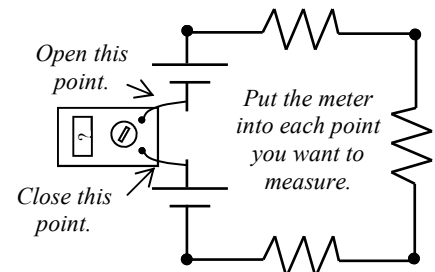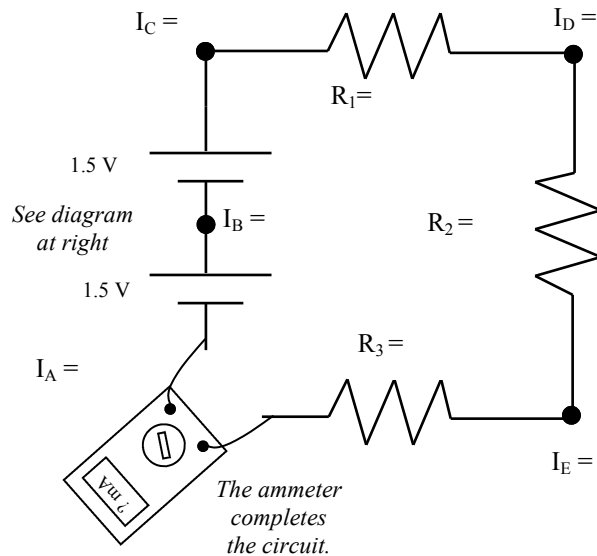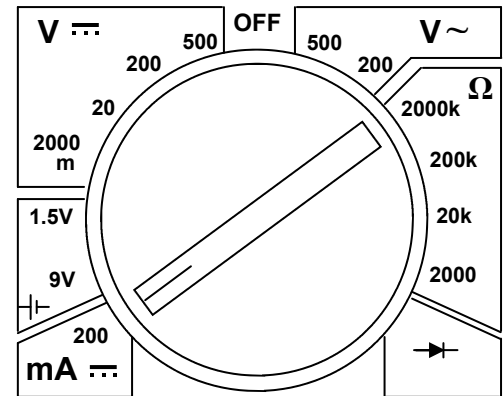5. Using your voltmeter, measure the voltages at each of the lettered points around the circuit and record them on the diagram. (To measure the voltage at A, put both the black and red probes on point A).

6. Analysis:
   A. Did the batteries add or subtract voltage?
   B. Did the resistors add or subtract voltage?
   C. Which resistor used the most voltage?
   D. Did the wires add or subtract voltage?
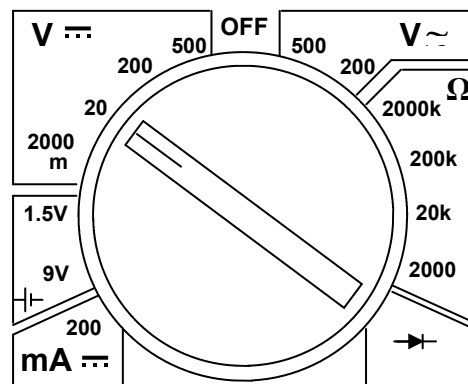
Part III—Current in a series circuit. (An Ammeter.)

1. Set your multimeter to measure 200 mA (milliamps) of current, as shown. You may need to change where the probes connect to the multimeter.

2. **WARNING: DOING THIS WRONG CAN DAMAGE THE MULTIMETER!** When measuring current the ammeter must be in series with the circuit OR you must break the circuit and but the multimeter into the circuit. THE AMMETER WILL COMPLETE THE CIRCUIT. Study the diagram below carefully before proceeding!

3. When you move to the next point on the circuit, close the previous point and open the next one. The ammeter completes the circuit at the new point. Study all three diagrams below to see how.

$I_C =$ $R_1 =$ $I_D =$

1.5 V

See diagram at right $I_B =$ $R_2 =$

1.5 V

$R_3 =$

$I_A =$

The ammeter completes the circuit.

$I_E =$

Open this point.

Put the meter into each point you want to measure.

Close this point.

Open this point.

Close this point.   *Put the meter into each point you want to measure.*

4. Analysis:
   A. How many paths are there for the electricity to flow in this circuit?
   B. How did the current change around the circuit?
   C. Why?

   D. What is your total resistance from Part I?
   E. What is your total (greatest) voltage from Part II?
   F. Using Ohm's Law (see below), calculate what the total current should be. This is the theoretical value.

   $R_{total} =$

   $V_{total} =$

   G. How does your theoretical value compare with your recorded value from the circuit?

   H. Give one possible reason why.

Current (in *amps [A]*) $\longrightarrow I = \dfrac{V}{R}$ Voltage (in *volts [V]*)

Resistance (in *ohms [Ω]*)

Current equals the voltage divided by the resistance.