

### Experiment 8: Simple Circuits

1. Obtain a battery, a flashlight bulb, and a short piece of copper wire. Remove the battery and bulb from their holders. Examine them closely, and find two ways to arrange them so the bulb lights. Sketch your arrangements:
  
2. Examine the 12 bulb/battery sketches attached.
  - a) Without testing them, which do you think will cause the bulb to light?
  
  - b) Now test your predictions. Which of them worked? Explain why those worked, but the others did not.
  
3. Obtain the test objects of steel, plastic, copper, rubber, nichrome wire, paper, and *another* flashlight bulb in a holder. Return the original bulb and battery to their respective holders. Inspect both sides of the battery holder to see how small plastic washers separate the frame of the holder from the terminals on the end.

Create a circuit of the battery and bulb to check that the bulb lights; call this level of bulb brightness a "5". Now predict the bulb brightness when each test object is inserted into the circuit (between the alligator clip and the battery terminal). Test each prediction and record your results.

Object	Prediction	Result	Type of material (see below)
Steel			
Plastic			
Copper			
Rubber			
Nichrome wire			
Paper			
2 <sup>nd</sup> Flashlight bulb			

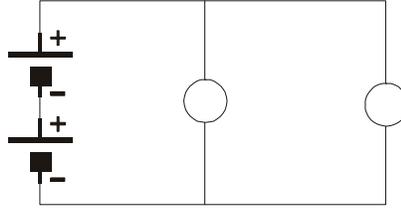
Those materials that allow unrestricted electricity flow are called *conductors* and those that allow none are called *insulators*. Materials allowing limited flow are called *resistors*. Now classify each type of material in the table above.

- Examine the flashlight bulb holder to see how the parts are arranged to power the bulb. Look on both sides and match up the wires and the contacts. Make a sketch of the socket (as seen from the bulb), noting the conductors and insulators:
  
- Now obtain 3 batteries with holders, 2 identical flashlight bulbs with holders, and some leads (pronounced "leeds") with alligator clips. Place a light bulb in a circuit with a battery. Then compare the effect of adding a second battery, connecting the batteries in tandem (this is called a "series" connection).
  
- Predict the effect of connecting 3 batteries in series in various combinations (+ to +, + to -, etc.). Check to see if your predictions are correct.

Prediction:

Result:

7. Consider this *schematic diagram* of 2 bulbs in *parallel*, and 2 batteries in series:



8. a) Predict the brightness of the 2 bulbs to each other:
- b) Test your prediction and explain the results:
9. a) Predict the brightness of either of the two bulbs in parallel, as shown, to either of the same two bulbs arranged in series, as in part 3.
- b) Test your predictions and explain the results.
10. Draw a schematic diagram of the circuit of part 9.
11. A *short circuit* occurs when another conductor provides a shortcut for the electricity flow (bypassing the resistors).
- a) Show what this might be on the schematic (in #7, above). How do you think it would affect the bulb brightness? Check it (very briefly) with a single battery, single bulb, and the copper wire and describe results.

b) Predict what would occur if the copper wire in a) were replaced by a nichrome wire (at least 12" long). Check this and describe results.

12. Create at least 3 more circuits. Use 2 bulbs and at least 2 batteries each time. Be creative!

For each circuit:

1. Draw a *schematic* diagram
2. Describe how bulb brightness compares
3. Explain the results

This is how the wires are connected inside the light bulb.

