**E4: Size and direction of current**

**Materials:**
- three batteries, three battery holders, 1 bulb, 1 bulb holder, on switch, wire

**Initial Instructions and questions:**
In this lab, I want you to think about the size and direction of the current. Using only what you have, are there any clues as to the size of the current? the direction of the current? Look at your definition of current from E1.

**Guide to notes in your lab notebook:**
1. What do you predict the outcome will be? Why?
2. While you are doing this lab, try to think of models you could you to describe your hypothesis and your results.
3. Make copious notes on exactly what you did and the outcome.
4. Did you or your fellow students have any misconceptions about this activity? Specifically, what evidence refuted this misconception?
5. Make a list of points you need to clarify. Discuss how you could address them experimentally.

**E5: Bulbs in series**

**Materials:**
- Three batteries, three battery holders, three bulbs, three bulb holders, one switch

**Initial Instructions and questions:**
Wire a circuit with 3 batteries and 1 bulb in series with a switch. Add another bulb in series. Add yet another bulb in series. What do we learn from this about how the number of bulbs in series affects the size of the current in the circuit? What do we learn from this about where in the circuit the current is biggest, and where it is the smallest? Discuss models with your partner and others.

**Guide to notes in your lab notebook:**
6. What do you predict the outcome will be? Why?
7. Make copious notes on exactly what you did and the outcome.
8. Were the predictions you and your fellow students made bout this activity correct? If not, specifically what evidence proved your prediction wrong?
9. Discuss models of current that we have talked about and try to make up one of your own. Can you use your model to conceptualize this experiment? To predict an outcome?
10. Could you think of any sources of error that could lead you to draw the wrong conclusion about this activity? If so, can you think of a way to guard against those errors?