**PREDICTING AND MEASURING CURRENT**

**Purpose**: Setting up electrical circuits. Predicting and measuring current.

**Materials**: 2 cells and holders, alligator clips, 2 bulbs, switch.

1. Using just 2 cells, wires, 1 light bulb, and switch, connect everything to make the light bulb light up. When it works, draw a circuit diagram of your set up below:

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| Draw an arrow to show the direction the electrons are flowing. |

1. What happens to *bulb brightness* when you add *another bulb in series (3 in total)* ? \_\_\_\_\_\_\_\_\_\_
2. What happens to bulb brightness when you add another cell (3 bulb, 3 cells in total)? \_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Connect the ammeter (in series) between the cells and the bulbs in such a way that the electrons are flowing from the cells, through the ammeter, then to the bulbs. Record the current: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_mA. This is the current BEFORE the bulbs.
4. PREDICT: do you think the current will be the same/less/more after the first bulb but before the second bulb? \_\_\_\_\_\_\_\_\_\_\_.
5. Disconnect the ammeter and place it AFTER first the bulb but BEFORE second bulb. Record the current: \_\_\_\_\_\_\_\_mA.
6. Reconnect the ammeter to be after all three bulbs. Record: \_\_\_\_\_\_\_mA.
7. Remove the ammeter, keeping everything else connected.
8. PREDICT what will happen to the other two bulbs when the middle bulb is unscrewed. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What is your reasoning? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

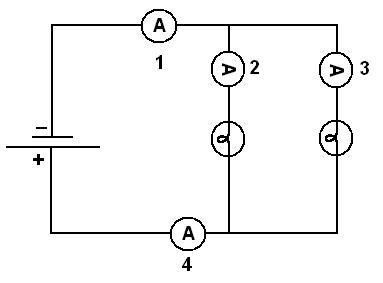
Go ahead and unscrew the middle bulb, keeping remainder of circuit intact. What happened? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Try unscrewing a different bulb instead. What happens to the other two bulbs when one of them is unscrewed? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| SUMMARIZE:  When in SERIES, what happens to bulb brightness when more are added? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  When in SERIES, what happens to the other two bulbs if one breaks/goes out/is disconnected? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  When in SERIES, how does the current entering the light bulb compare with current leaving the bulb? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.Draw a conclusion about what happens to electrons when entering and leaving the bulb. \_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |

CHALLENGE: How can you make the other bulbs stay lit when one of them is connected but unscrewed? Draw your circuit diagram below:

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CURRENT IN PARALLEL CIRCUITS

1. Build a circuit (2 cells, 3 bulbs) without any ammeters to look like the diagram on the right.
2. Are the bulbs same/brighter/dimmer compared to when they were in series? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Measure the current with an ammeter at position #1: \_\_\_\_\_\_\_\_\_\_\_\_\_
4. Measure the current with an ammeter at position #2: \_\_\_\_\_\_\_\_\_\_\_\_\_
5. Measure the current with an ammeter at position #3: \_\_\_\_\_\_\_\_\_\_\_\_\_
6. Measure the current with an ammeter at position #4: \_\_\_\_\_\_\_\_\_\_\_\_\_
7. Compare current at Position #1 (total current before branches) to position #4 (total current after branches) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
8. Compare current at position 2 to position 3 \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
9. Compare currents of positions 2 or 3 to Total Current (#1). Are they the same, more, less? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
10. PREDICT what you think would be the current entering a 3rd bulb in parallel.

SUMMARIZE: What general rule can you apply to current *at each bulb* when they are added in parallel?

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If wires are difficult, you can try this PHET simulation to build your own circuits:

<https://phet.colorado.edu/sims/html/circuit-construction-kit-dc/latest/circuit-construction-kit-dc_all.html>