More Experiments with Electric Circuits

Name _____

We have seen that in order to get the bulb to light, we have to connect a complete "circuit." A circuit is a closed pathway of conducting material plus a battery. The battery is part of the pathway. (Most metals are conducting materials, but so are some nonmetals, such as the graphite in pencil lead.)

We have also seen that sometimes the wires and the battery can get quite hot. This is evidence that something is flowing through the wires. We will call this flow an "electric current." (Although we can not observe it directly, it has been found that this electric current is due to the motion of small charged particles in the wires.)

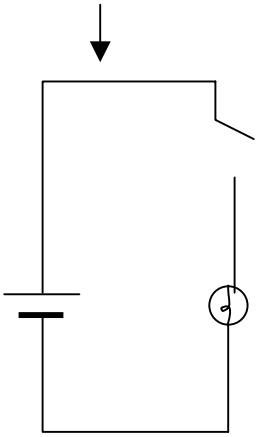
The flow of electric current is responsible for the bulb lighting up. We will assume that the *quantity* of electric current flowing though a bulb is related to the *brightness* of the bulb.

1. Do you think that the electric current flows one-way, from the battery to the bulb, or does it make a round trip (out of one terminal of the battery, then through the bulb, and then back to the ***other*** terminal of the battery)? Explain your answer: *Why* do you think you're correct?

2. If two bulbs are equally bright, what can you say about the amount of electric current flowing through each of them (compared to each other)?

3. If one bulb is brighter than another, what can you say about the amount of electric current flowing through each of them (compared to each other)?

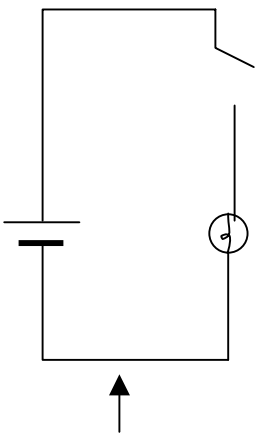
4. Set up this circuit:



At the location indicated by the arrow, wrap the wire around a compass two times and hold it very still, so that the compass needle is still.

Now, close the switch and carefully observe the compass needle. What do you see?

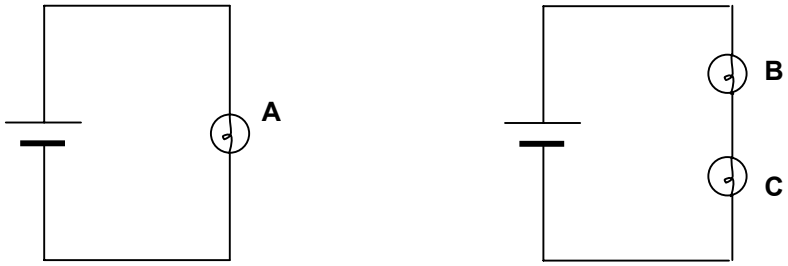
5. Suppose you now change the location of the compass to the position indicated by the arrow here:



What do you think you will observe when you close the switch? Do you think the compass needle will move? Why, or why not?

6. Try the experiment: wrap the wire around a compass in position #2, and close the switch. What do you observe?

7. In the circuit on the left, bulb A is connected to the battery by itself. In the circuit on the right, bulbs B and C are connected to the battery, one right after the other. (The ***same battery*** is used in each circuit.)



What can you say about the brightness of these three bulbs, compared to each other? List the bulbs in order of brightness: brightest bulb first, then next brightest, and then the dimmest bulb. If you think two of the bulbs will be equally bright, use an "equals" sign (=). (So if bulb A is as bright as bulb B, write: A = B. If all three bulbs will be equally bright, write A = B = C.)

Brightest _____Dimmest

Explain the reasons for your answer.

8. In the circuit with two bulbs, suppose you remove one of the bulbs from its socket. Do you think the other bulb will stay lit, or will it go out? Why?

9. Now set up the circuits, and see what happens. Which bulbs are brightest, and which are dimmest? (Pay attention to ***large*** differences, if there are any. Don't worry about very small differences which are hard to notice.) In the circuit with two bulbs, what happens if you remove one of the bulbs from its socket? Describe your observations here:

10. What can you say about the ***amount of current*** flowing through each of the three bulbs? (Which has the most, which has the least, etc.)

11. Based on your observations, would you say that current is "used up" in the first bulb (in the two-bulb circuit), or is the amount of current flow the same through both bulbs? Why?

12. Do you think that the order of the bulbs in this circuit might make a difference (that is, which bulb is closer to the positive terminal of the battery)? Check your answer by switching the two bulbs.

13. Based on your observations, can you tell the direction of current flow through the circuit?

14. How does the amount of current flowing through the single-bulb circuit compare to the amount of current flowing through the two-bulb circuit?

The amount of current flowing through the battery in the single-bulb circuit is (choose one):

greater than

less than

equal to

the amount of current flowing through the battery in the two-bulb circuit.

Explain the reasons for your answer.

15. Try to draw a diagram of a circuit with two bulbs, where one bulb will stay lit even when you remove the other bulb from its socket. Explain why you think that your circuit will work.

16. Now build your circuit and see if it works. Does the second bulb stay lit if you remove the other one? If it doesn't, design a circuit that will work. Draw the diagram of your circuit here:

17. Compare the brightness of the two bulbs in your circuit to each other. Do they have the same amount of current flowing through each of them, or does one of them have more current flowing through it than through the other one?

18. Is the amount of current flowing through each bulb in this circuit **greater than, less than,** or **equal to** the amount of current flowing through the bulb in the ***single-bulb*** circuit?

19. Is the amount of current flowing through the battery in this circuit **greater than, less than,** or **equal to** the amount of current flowing through the battery in the ***single-bulb*** circuit? Explain your answer.