PHY 100 Lab: DC Circuits, Part I
Electric Current Name_____

Date_____ Course & Section_____ Partner_____

1. *Do this step on your own, not with your partner.* You have a light bulb, a battery and one piece of wire. Make the light bulb light. When you have the bulb lit, carefully draw the arrangement that made it light in the space below.

2. On the separate sheet titled "Activity Sheet 1", predict which arrangements you think would make the bulb light and which ones would not. Then, test them experimentally and write down those findings next to the predictions.

3. Do this step with a partner. Put one of your batteries in the holder and use two pieces of wire to connect it to the bulb socket. Screw a bulb into the socket. Does it light? If not, you may have some loose connections. In the space below, answer the following question with a short paragraph: Why would a loose connection prevent the bulb from lighting?

_____

_____

_____

_____

_____

4. Refer to the "dictionary" sheet that shows what symbols represent components of circuits like the one you have just built. Using these symbols, draw the schematic diagram for this circuit in the space below. *Before you go on to the next step, have the instructor check your diagram.*

5. Refer to circuit diagrams # 1 a-d in the accompanying packet. These diagrams show two batteries in "series" connected to the bulb. The orientation of the "plus" and "minus" ends of the batteries must be correct for the bulb to light brightly. There are four possible ways to orient the batteries: plus connected to plus, minus connected to minus, plus of battery one connected to minus of battery two, and minus of battery one connected to plus battery two. On the diagram 1 sheet, identify which of these four orientations correspond to each of the four schematics a, b, c and d.

Only two of these four ways light the bulb brightly. Try all four ways. For each case, indicate whether the bulb is dimmer, the same, or brighter than it was with just one battery. Why might the orientation of battery "polarity" make a difference? How could you use a third battery and extra wires to be more certain? Record your observations below.

6. Leave the two batteries connected in the way that lit the bulbs brightest. Put another bulb in a socket and connect it in series with the bulb already attached to the batteries (to do this, one of the wires connected to the original bulb socket has to be detached). Draw the circuit diagram for this circuit in the space below. (If you are ever uncertain of your wiring, please ask for help!)

7. Are the bulbs dimmer, the same brightness, or brighter than the single bulb was with the same arrangement of two batteries in series?

8. Refer to diagram 2 in the accompanying packet. This shows two bulbs connected in a basically different way – in "parallel". Reconnect your circuit, keeping the two batteries in series with one another, but with the bulbs in parallel, and again record whether the bulbs are dimmer, the same, or brighter than they were in series. (You may want to work with another table and make a direct comparison between a parallel – bulb and a series – bulb circuit).

9. Do you think more electricity flows through a bulb when it is in parallel with another bulb or when it is in series with another bulb? Why? Does your answer agree with your partner's? If not, how does your answer differ?

_____

_____

_____

_____

_____

_____

_____

10. In this step we will begin to test the prediction you just made in step 9. You can measure electrical flow with an ammeter or with a multimeter set up to measure amps. We will use a battery powered digital multimeter (DMM) for this measurement. To connect the DMM, refer to diagram #3. To make this connection, replace the wire from the plus end of the batteries with the DMM and its test leads, attaching the test leads to the battery holder and first bulb with the "banana plugs". (To measure electrical flow, or "current" through a bulb, the current must have no other path to take except through the meter on its way to or from the bulb. The meter itself cannot block or resist the flow of electricity or the bulb won't light properly, therefore the meter must behave like a piece of wire…, a wire that happens to have a digital readout of what flows through it.) The DMM switch should be set to 2 A dc (this setting is in the section marked "A---"). Record the reading below. Did the brightness of the bulbs change noticeably when the meter was applied compared to when it wasn't?

11. Now apply the meter to a different place in the same circuit as shown in diagram 4. You may want to have the instructor check your wiring. Record the reading below.

12. Look at diagram 5 but don't try it yet; the DMM will be measuring the current through just the second bulb. What do you predict the reading will be? Why?

13. Now apply the meter as shown in diagram 5 and record the reading. How does it compare with your prediction?

14. Look at diagram 6. Do you think the current will be less than, the same as, or more than the current you recorded for diagram 3 in step 10? Why?

15. Connect the bulbs in series with the batteries and the DMM as in diagram 6. Record the current. Is it less, the same, or more than the current you recorded in step 10? How does this compare with your prediction?

16. Suppose you remove one of the bulb sockets so you have a circuit containing two batteries, the DMM and one bulb, all in series. Before you try it, predict what the current reading will be and record your prediction in the space below.

17. Connect the circuit described in step 16 and record the current reading. How does it compare with your prediction?

18. Is the current through the batteries larger in the circuit with two bulbs in series or in the circuit with two bulbs in parallel? Which one produces the larger total amount of light? Which would you expect to deplete the batteries the fastest? Why?

_____

_____

_____

_____

_____

_____

_____

_____

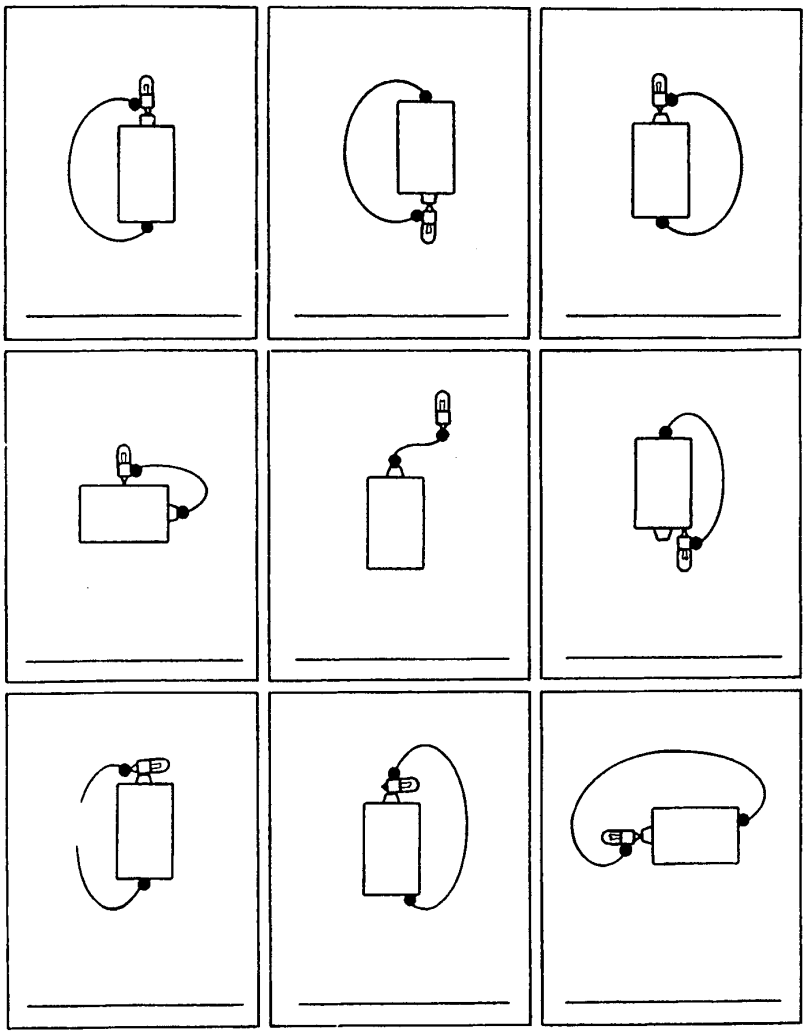
19. If you were constructing your own string of holiday lights on a long run of wires, how would you rather connect them, in series or parallel? Why?

Activity Sheet 1

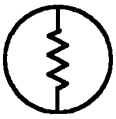
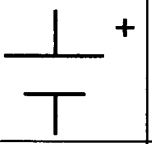
Name: _____

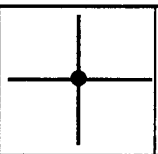
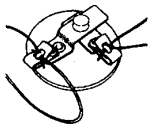
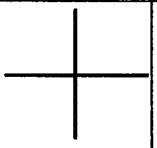
Date: _____

Will the bulb light or not? Below each picture, make your prediction by writing either "On" or "Off."



Circuit Key

Bulb		
Battery		
Wire		

Connected Wires		
Crossing Wires		
Switch		

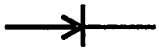
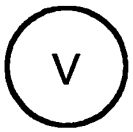
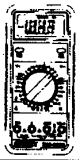
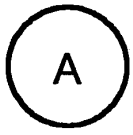
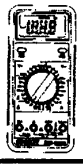
Diode		
Volt Meter (Measures Voltage)		
Amp Meter (Measures Current)		

Figure 5-2

Fahnestock clip

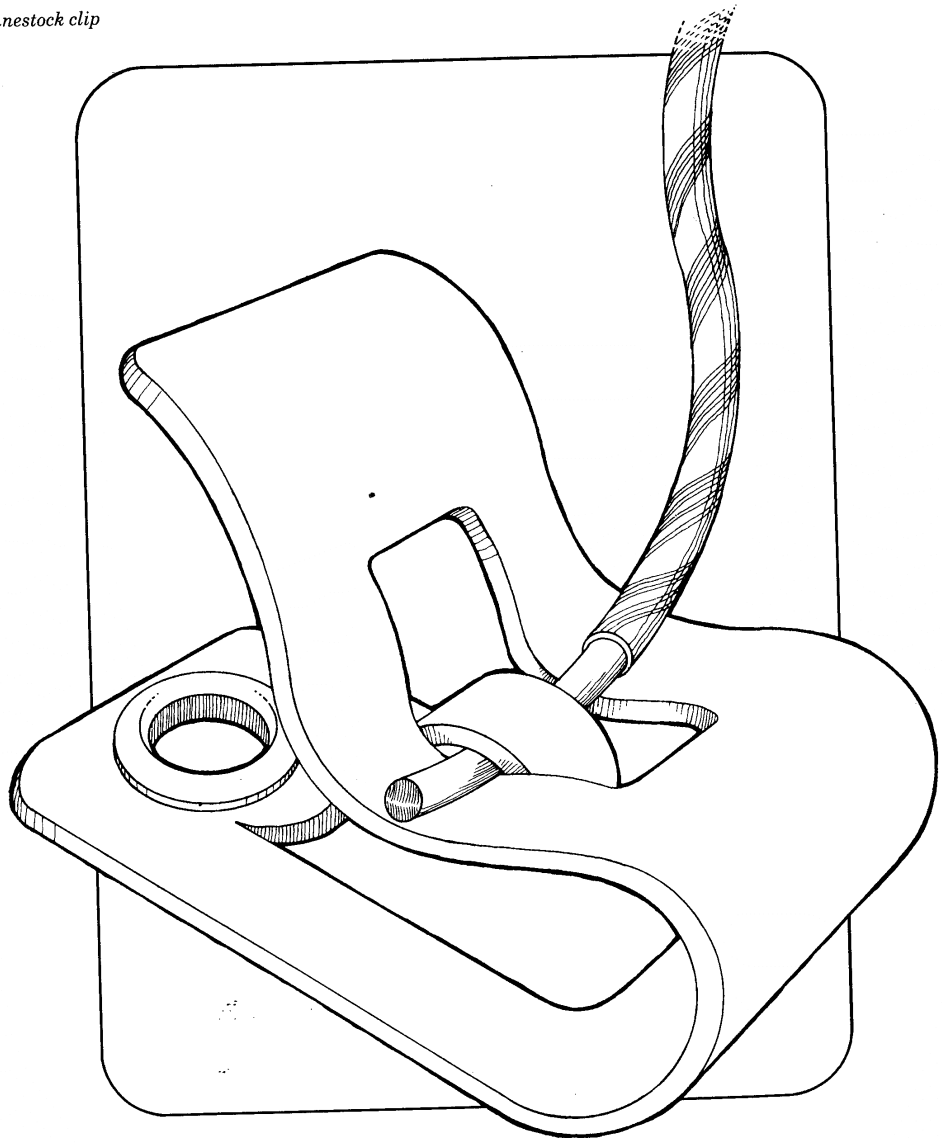
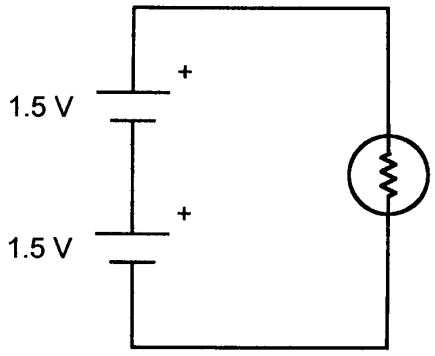
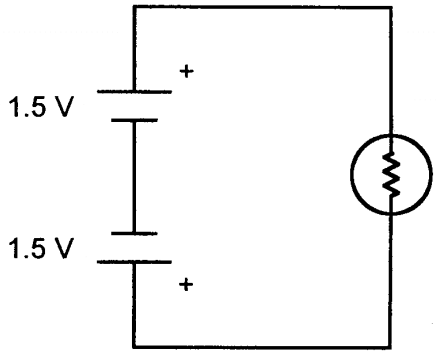


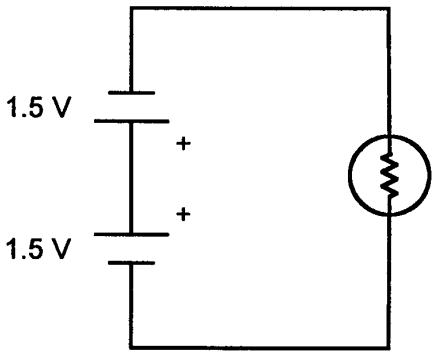
Diagram 1



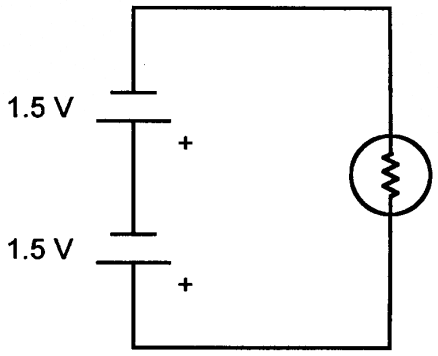
(1a)



(1b)



(1c)



(1d)

Diagram 2

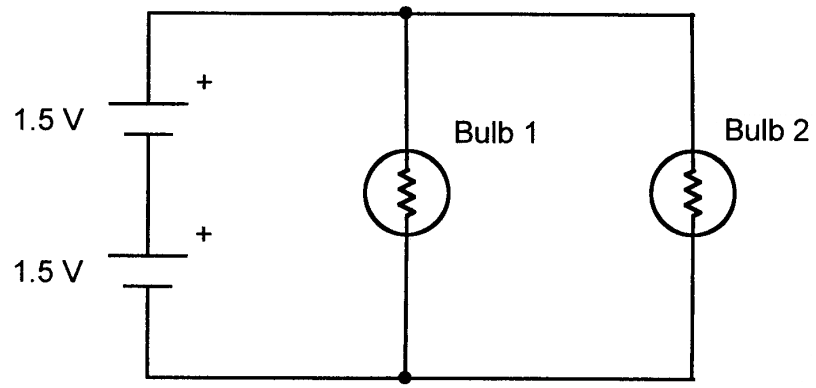


Diagram 3

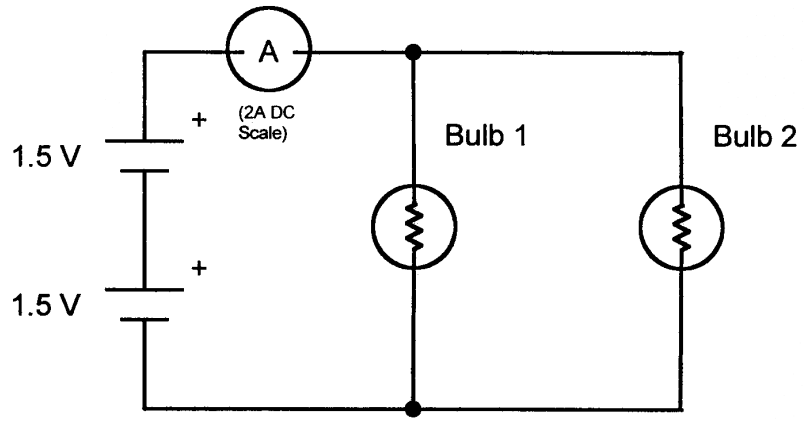


Diagram 4

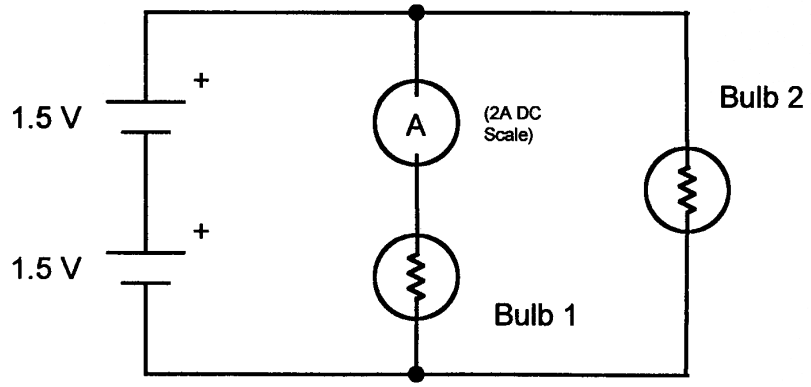


Diagram 5

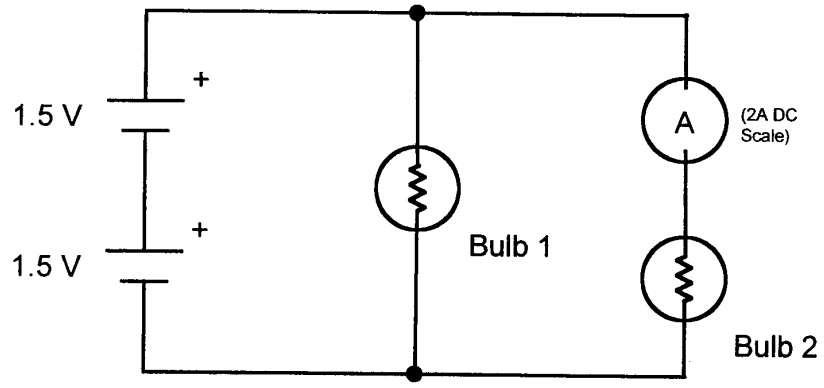


Diagram 6

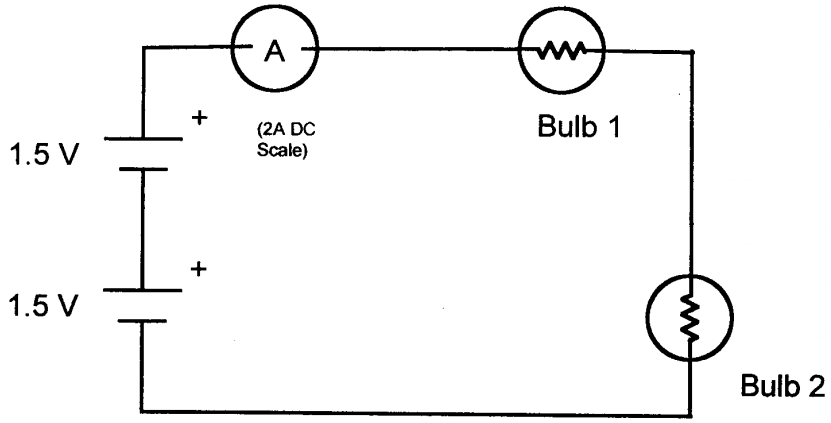


Diagram 7