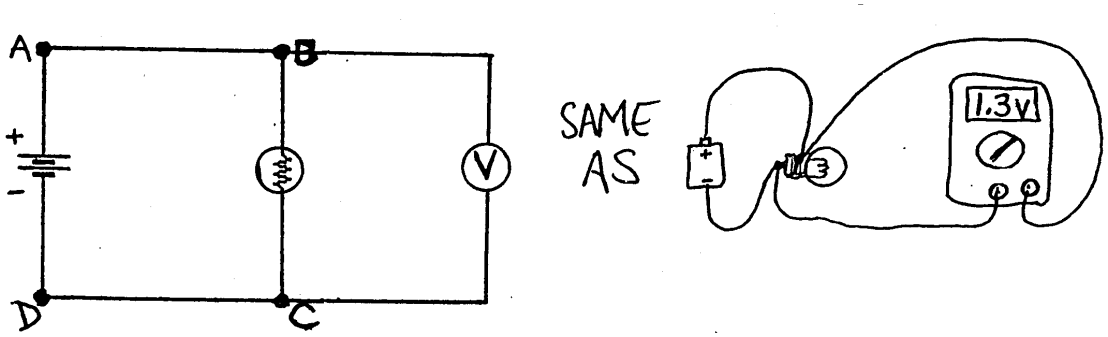
Physics 100's Lab DC Circuits 2 - Voltage

Name_____ Course & Sec_____

Partner_____ Date_____

1. The diagram below shows a circuit consisting of a battery and a light bulb with connection points marked A through D, and a DMM (Digital Multimeter) set to measure 20 Volts DC full scale. The diagram shows the DMM connected for measuring the "voltage drop" across the bulb (the energy per unit charge lost between point B (black lead) and point C (red lead)). This voltage is recorded below as B-C. Using this example of how to connect the DMM to measure voltage, construct the circuit so that the bulb lights and then measure the four voltages indicated. The first letter always indicates where the black lead should go and the second letter where the red should go.



A-B_____ B-C_____ C-D_____ D-A_____

2. Consider point D as being at the negative end of the battery, and suppose the wire there is disconnected. DON'T disconnect it yet! ***Predict*** the following voltage readings. Think about the gain or loss of energy between the points:

A-B_____ B-C_____ C-D_____ D-A_____

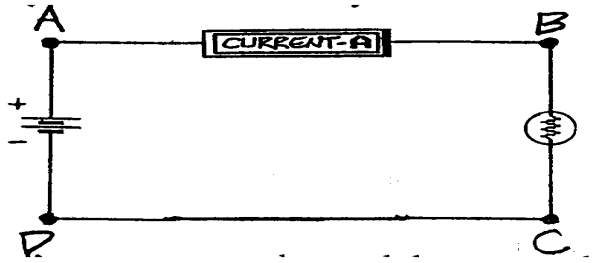
3. NOW, disconnect the wire at point D and measure the voltages.

A-B_____ B-C_____ C-D_____ D-A_____

4. How do your measurements compare with your predictions? Considering the gain or loss of energy between the red and black probes, why should the results be what they are?

5. What do you think the algebraic signs (plus or minus) of the readings indicate about what is happening in each part of the circuit?

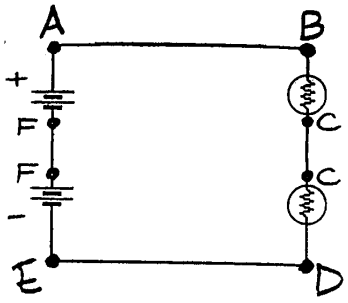
6. Using the battery, bulb, and DMM from above, connect the circuit as shown in the diagram below. It shows the DMM, indicated with an A, connected to measure the current through the bulb. Notice that the DMM must be connected in series to measure current, whereas before it was connected in parallel to measure voltage. BEFORE you make the final connection, have your instructor check your circuit.

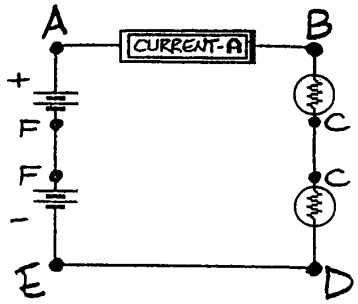


7. After making the final connection, measure and record the current through the bulb.

Current = _____ amps

8. Construct the circuit as shown in the diagram on the left below. Measure and record the voltage drops across the pairs of points shown. Then, place the DMM in the circuit as shown in the diagram on the right and measure and record the current in the circuit.





A-B_____B-C_____C-D_____D-E_____

E-F_____F-A_____ E-A_____B-D_____ Current_____

9. How do voltage drops across bulbs in series compare to those across batteries in series? Determine the total voltage across the bulbs and the total voltage across the batteries and compare these two totals.

10. If you don't yet know what it means to "short circuit" a device with a wire, ask your instructor for help. Otherwise, use a piece of wire as a jumper to short out the bulb connected between points B and C. What happens to each of the bulbs? Explain what you think made this happen in terms of electric current flow and/or energy usage.

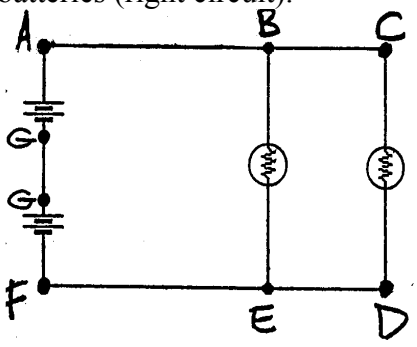
11. With the jumper in place, repeat the voltage and current readings taken in step 8. Remember that you will need to remove the DMM, used as an ammeter, from the circuit use it as a voltmeter to measure the voltages across the pair of points shown. THUS, measure the current first, remove the DMM, reconnect the circuit, and use the DMM as a voltmeter to measure the voltages.

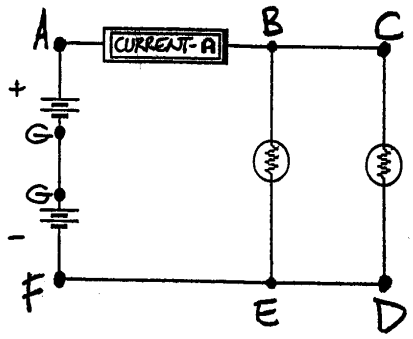
A-B_____B-C_____C-D_____D-E_____

E-F_____F-A_____ E-A_____B-D_____ Current_____

Which of the readings differs from those recorded in step 8? Why? Be specific.

12. Construct the circuits as shown below. Measure and record the voltage drops across the pairs of points indicated (left circuit) and the current through the circuit from the batteries (right circuit).





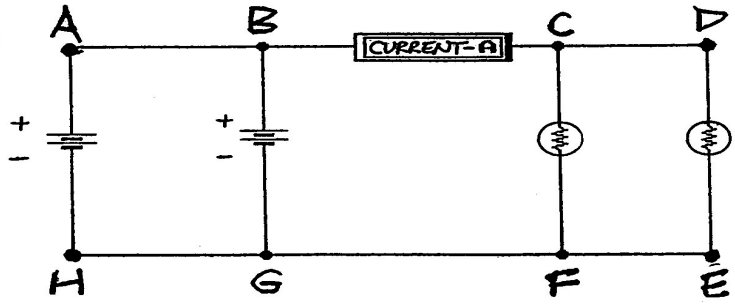
A-B_____ B-C_____ B-E_____ C-D_____

D-E_____ E-F_____ F-G_____ G-A_____

F-A_____ Current = _____

13. Predict what would happen if the **batteries** in the circuits above were connected in parallel instead of in series. Predict what the voltage drop would be across the batteries.

14. Measure and record the voltage drops and the current (with the DMM placed as shown) for the circuit below.



H-A_____ G-B_____ C-F_____ D-E_____

Current = _____

Why do you think the current is different than the current in step 12? Will the batteries last longer? Why or why not? How did the observed results compare with your prediction?

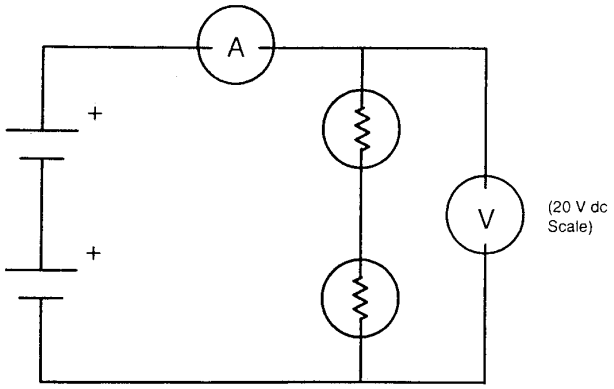
15. Which of these two circuits produces more total light? In which of these two circuits is the most electrical power being consumed? How does the difference between the two circuits in total amount of light produced compare with the difference in current?

16. Remember, when voltage is measured, the DMM is connected to the device being tested in parallel, in contrast to current measurement, in which the meter is always connected in series with the component of interest. Diagrams 8a and 8b show the DMM connected across the bulbs in the two circuits. What is the voltage across the bulb in the one battery-one bulb circuit? What is the voltage across the pair of bulbs in the two battery – two bulb circuits?

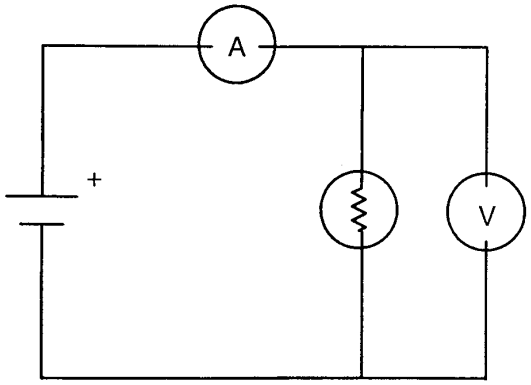
17. Now connect the DMM as shown in diagram 9a and 9b. What is the individual voltage across each of the two bulbs in the two bulb – two battery circuit? How do the individual voltages relate to the total voltage across the pair?

18. How do you think voltage relates to power consumed, for a given current?

Diagram 8

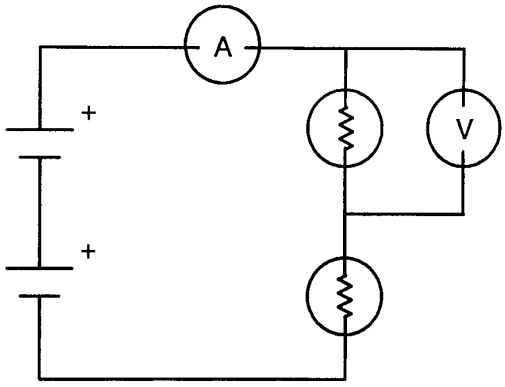


(8a)

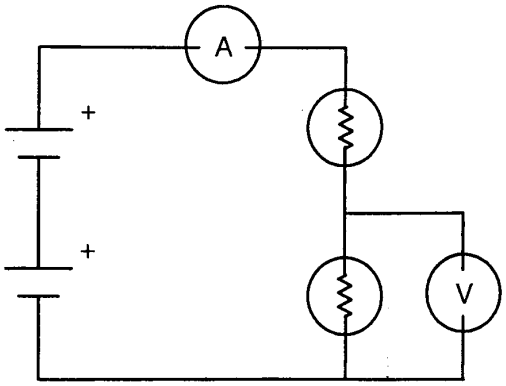


(8b)

Diagram 9



(9a)



(9b)