PHY 103 Lab: DC Circuits III

Procedure:

1) Attach the two wires with large banana plugs into the digital multimeter (DMM) jacks marked "COM" and "VΩ", and move the dial onto the DC voltage setting marked "200m". This setting will read voltage up to 200 millivolts (which means 0.2 volts).

2) Identify the "+" and "-" ends of the batteries in their holders, as marked on the battery cases. NEVER attach a wire alone, without a lightbulb or DMM, across the battery. It is dangerous!

3) As you have learned two weeks ago, two batteries connected in series means hooking the "positive" end from one to the "negative" end of the other. Do that now, using a small piece of wire and the two spring clips in the holders. We'll denote battery #1 as being the battery whose positive terminal is free, and whose negative terminal is hooked to the positive end of battery #2.

4) With your DMM switched on, put its red lead to the positive end of one battery, and black lead to the other end *of the same battery*. Record your reading below, in millivolts and in volts. Perform the same thing to the other battery, with the red lead on the positive and black lead on the negative, and record that reading below.

	Battery #1	Battery #2
in millivolts		
in volts		

5) Now hook the red lead to the positive terminal of battery #1 and the black lead to the negative terminal of battery #2. What is this reading? Record it below in millivolts and volts. Can you identify this reading as being the sum of two other voltages? If so, is it sensible that they should?

Reading across both batteries:_____millivolts _____volts

6) Reverse the two leads, and record the voltage across the two batteries with the black lead on the available positive terminal and the red lead on the available negative terminal. What do you observe?

7) Now connect the two batteries into a series with the two lightbulbs. Draw the sketch of the series circuit. With the DMM on the same setting as before, put the leads across the first lightbulb and record the reading in both millivolts and volts. Is your reading positive or negative? If it is negative, explain how you would redo this step to make the reading positive. (Examine step 6 if you need some help here.)

8) Now measure the voltage reading across lightbulb #2. Record this reading in millivolts and volts below. Make sure your reading is positive. How does this number compare to the voltage you took across the other lightbulb in step 7?

9) As you did with the batteries, now connect one lead to the wire entering the first lightbulb and connect the other lead where the wire leaves the second lightbulb. You are now measuring the voltage across *both* lightbulbs at once. Predict what the voltage across both bulbs will be, then perform the test. Were you correct? Record your readings, again in millivolts and volts.

10) Is this voltage across the two bulbs the same or different than the voltage across the two batteries? Is it sensible that the voltage in the circuit due to the batteries show up across the lightbulbs?

11) Remembering how to insert the DMM into the circuit in order to read the current in the lightbulbs, remove the wire leading from the batteries to the first lightbulb. Adjust the dial on your DMM from V to the "2A" scale. IT IS VERY IMPORTANT TO DO THIS BEFORE HOOKING THE DMM INTO THE CIRCUIT! Now wire the DMM's leads into the circuit as you learned two weeks ago, and record the current (remember its unit is Amps).

12) This current flows into the first lightbulb from the batteries. How much current flows into the second lightbulb? (You don't need to measure it, just recall how current flows in a series circuit.)

13) The power emitted by a lightbulb (or any resistor in an electrical circuit) is computed by the formula P = ?, where P is power, I is the current in Amps, and V is the voltage across the resistor in Volts. Compute the power emitted by each lightbulb. What is the unit of power (hint: how do we rate lightbulbs?)?

14) Now let's see how things change when the lightbulbs are wired into a *parallel* circuit. Hook the two lightbulbs in parallel with the 2 batteries. Draw the sketch of this parallel circuit below.

15) As before, we will measure the voltage across each lightbulb. *To do this, remember to switch your DMM back to the "2000m" setting on the V scale.* Once again, find the voltage across lightbulb #1. Record it below in millivolts and volts. How does it compare with the voltage across the batteries from step #5?

16) Predict the voltage across lightbulb #2. Measure this voltage, and record it in millivolts and in volts. Was your prediction correct?

17) Now we'll measure the current in each lightbulb, exactly as you did two weeks ago. Set the DMM into "2A" scale, and replace one wire in the circuit with the DMM. What is your reading?

18) Predict the current in the other lightbulb, then measure it. Were you correct?

19) As before, use the power equation to compute the power emitted by each lightbulb. Is it bigger or smaller than the power emitted in the series circuit? Is there a way to simply observe each case and predict which circuit emits more power? How would you pick which circuit emits more power if you didn't do any measurements?