

Series and Parallel Circuits

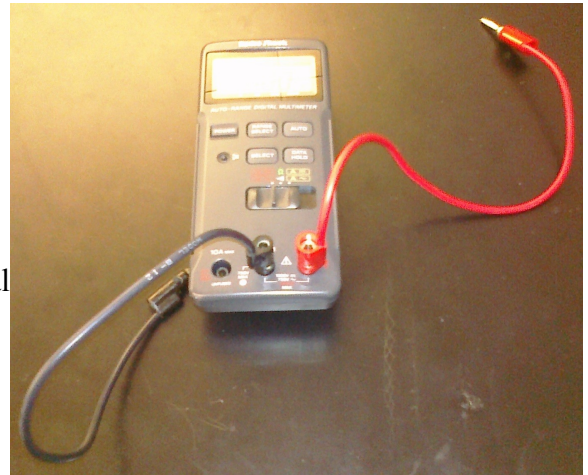
Name _____ Per _____

Purpose:

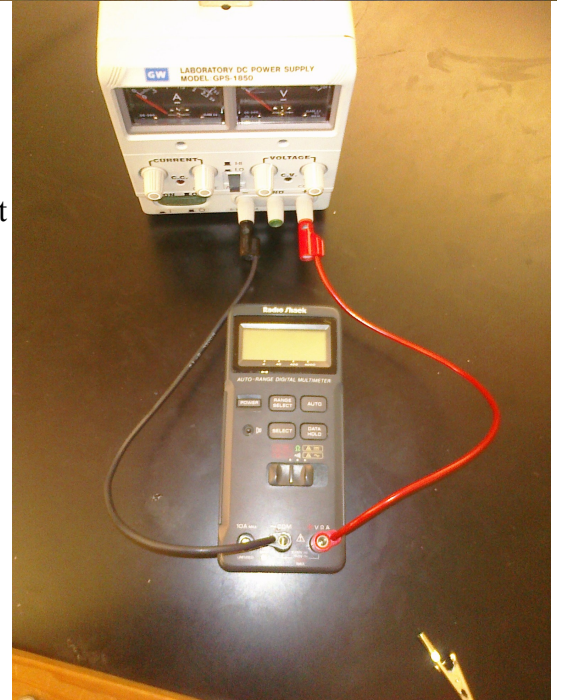
- Create series and parallel circuits using light bulbs as resistors
- Measure current and voltage
- Understand how current flows in a circuit
- Compare series and parallel circuits

This document will be easier to see when viewed or printed in color. Use your computer to download the pdf from the class website. Materials: Power supply, digital voltmeter, ammeter, 7 leads, 4 alligator clips, bulb holder, 2 light bulbs

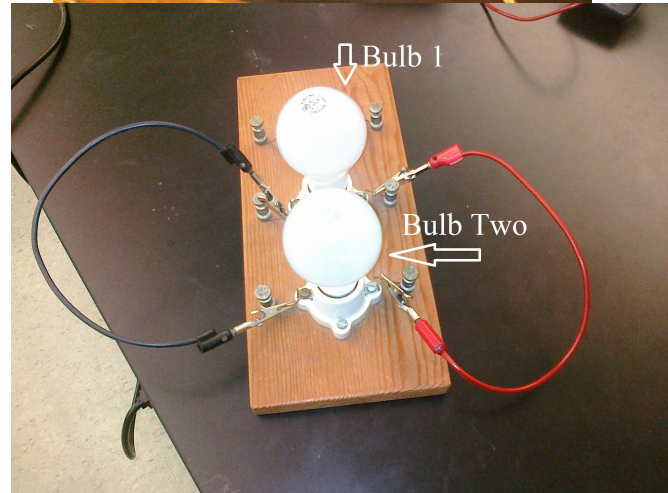
We will use a digital voltmeter. Connect a red lead to the +V terminal of the meter. Connect a black lead to the -COM terminal. Switch the meter to read voltage (left side) Turn on the meter.



The knobs for current will not affect the current, as long as they are not at zero. Make sure they are not turned all the way to the left. Connect the meter to the + and - terminals of the power supply. Turn on the power supply. Use the course and fine adjustment knobs to make the voltage 15V ($\pm 0.2V$ is ok.)



Connect the the light bulbs to each other on both sides. Use a black lead on one side and a red lead on the other. This connects them in parallel. Draw a circuit diagram for this connection in the box

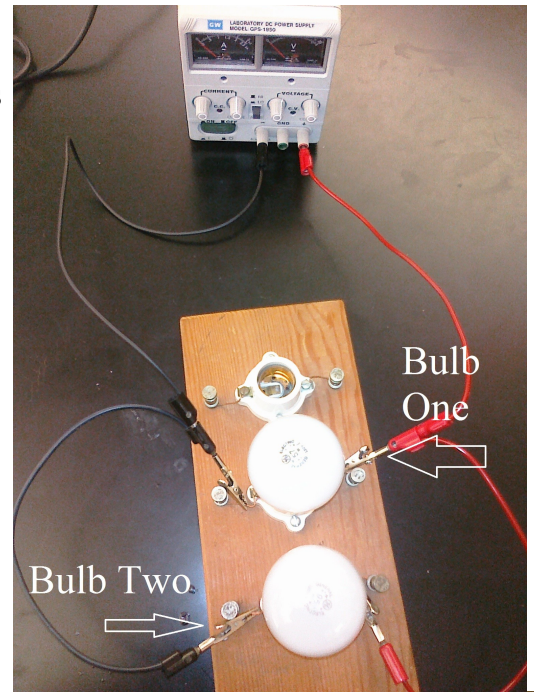


Connect the negative terminal of the power supply to the black wire connecting your bulbs. Connect the positive terminal to the red wire connecting your bulbs. This connects the power supply and your bulbs in parallel. Draw a circuit diagram for this connection in the box. What is the voltage across bulb 1 (V_1) and bulb 2 (V_2)? You may use the voltmeter to measure them.

$V_1 =$ _____

$V_2 =$ _____

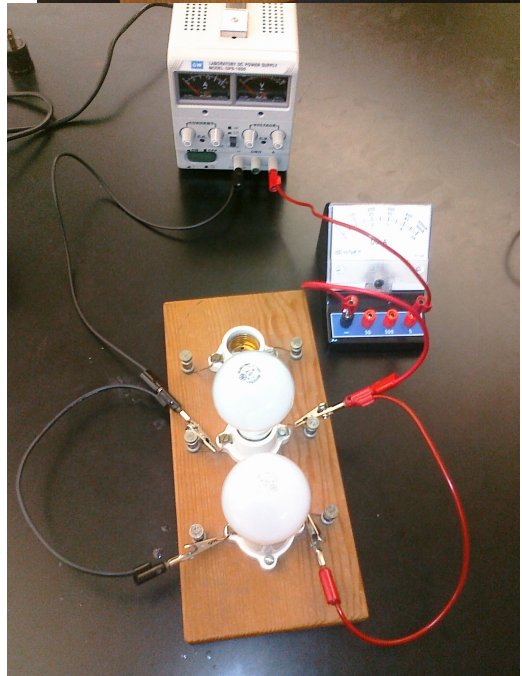
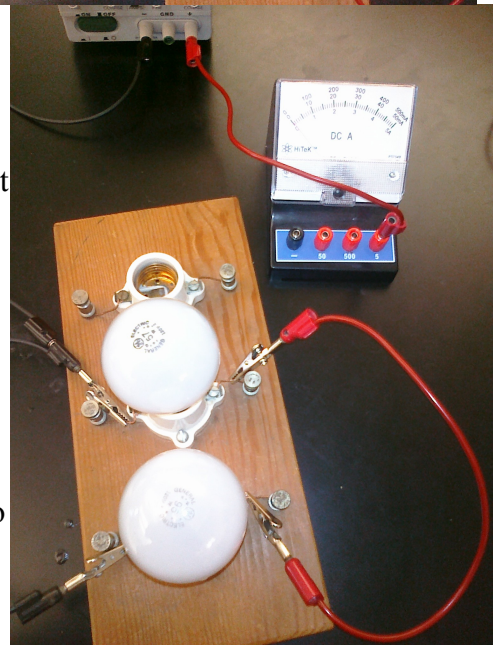
$V_1 + V_2 =$ _____



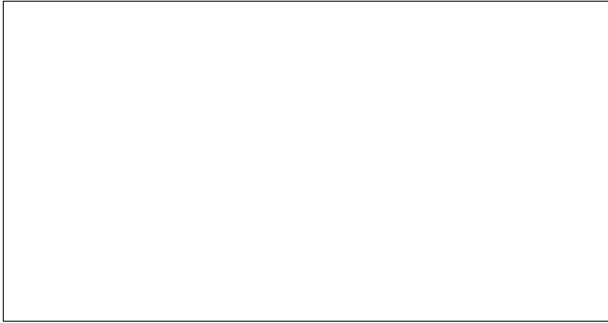
Disconnect the positive lead from the battery from the light bulbs. Connect it instead one of the positive terminals of the ammeter.

Connect the negative terminal of the voltmeter to the red lead connecting your bulbs together. This has forced the current coming from the battery to go through the meter before reaching the bulbs, and will measure the total current in your circuit. Draw a circuit diagram for this connection in the box. What is the total current (I_T) Try using all three positive terminals of the ammeter. Use the terminal which gives you the measurement which moves the needle the highest without being past the maximum (ie: whichever one lets you read current with the most accuracy.)

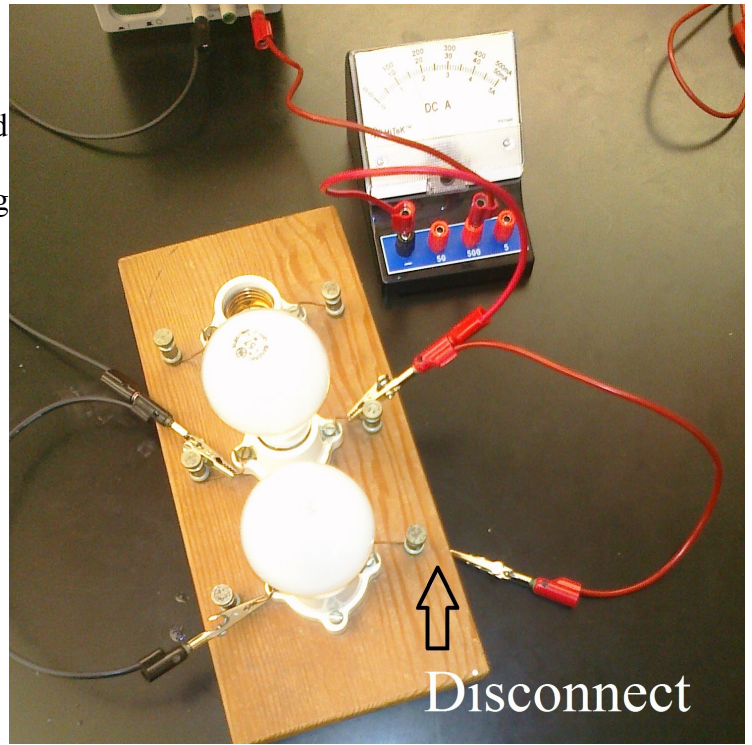
$I_T =$ _____



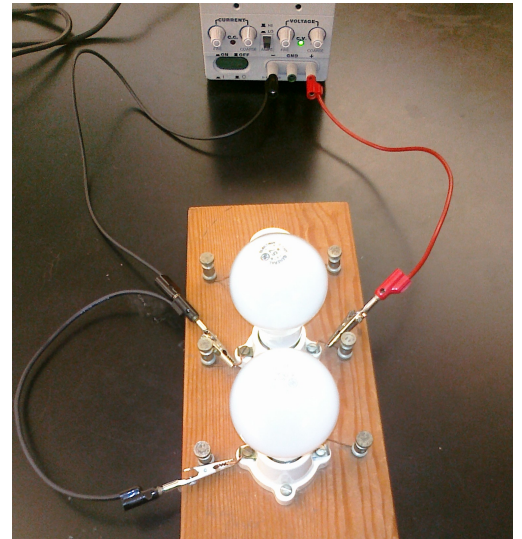
Disconnect bulb 2 from the circuit by removing the red lead connecting it. What happens to the current? Now no current runs through bulb 2 and the meter is reading the current through the first bulb. Draw a circuit diagram for this connection in the box. What is I_1 ?



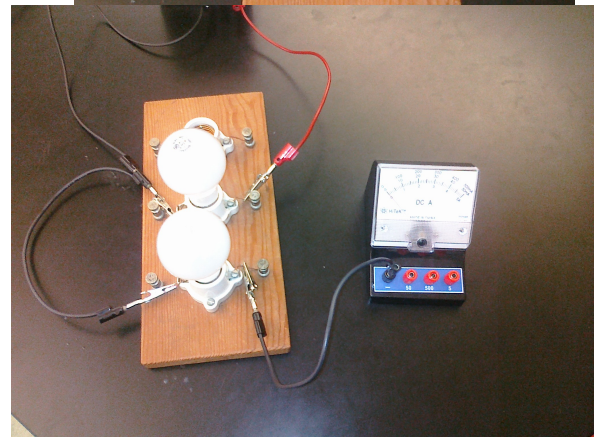
$I_1 =$ _____



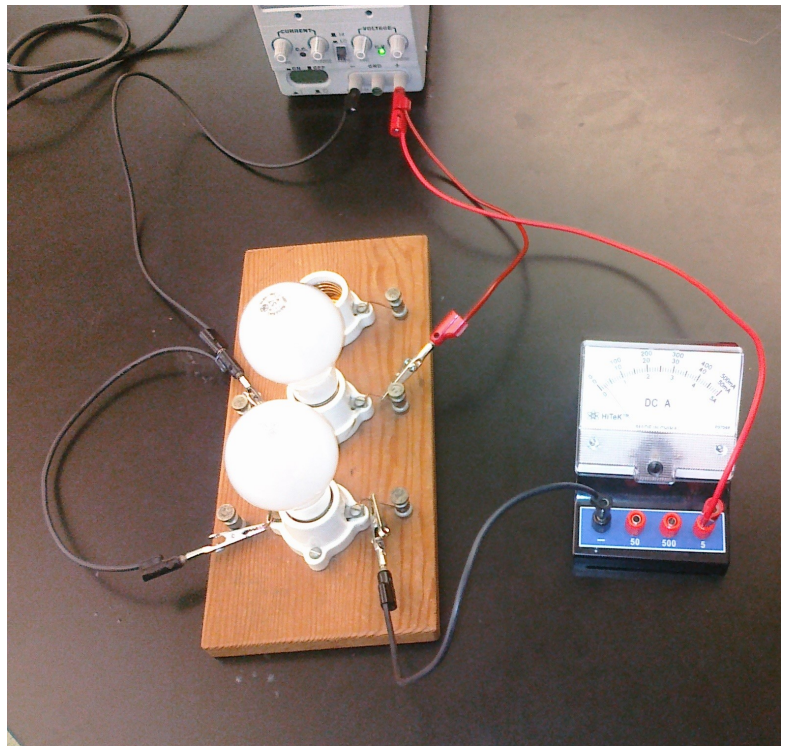
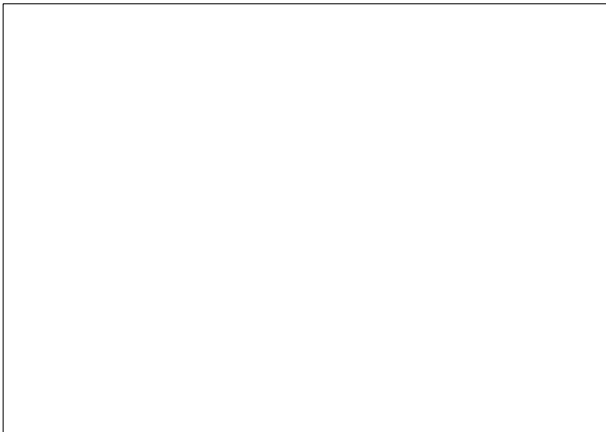
Remove the ammeter from the circuit and connect the meter back to bulb 1 directly. Remove the red lead connecting bulbs 1 and 2.



Connect bulb 2 to the negative end of the ammeter.



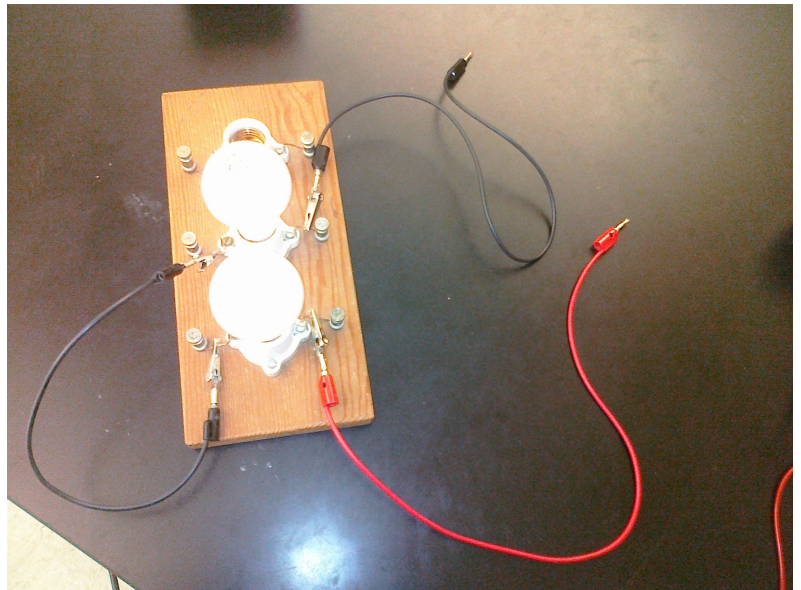
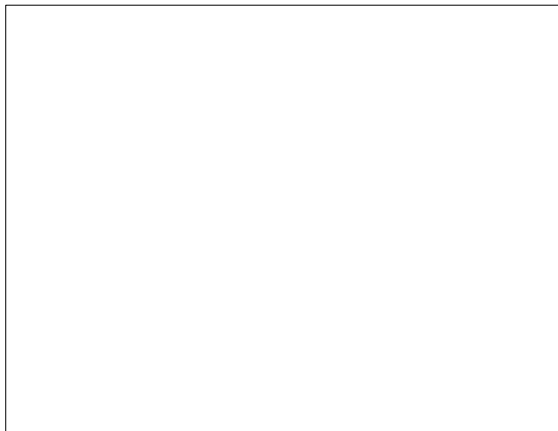
Connect the positive end of the ammeter to the power supply. Now the ammeter reads the current through bulb 2. Draw a circuit diagram for this connection in the box. What is I_2 ? Compare the sum of I_1 and I_2 to the total current.



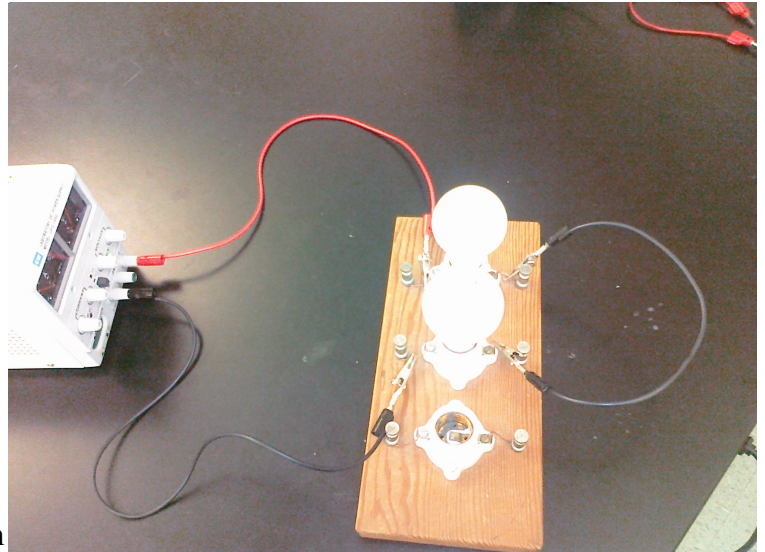
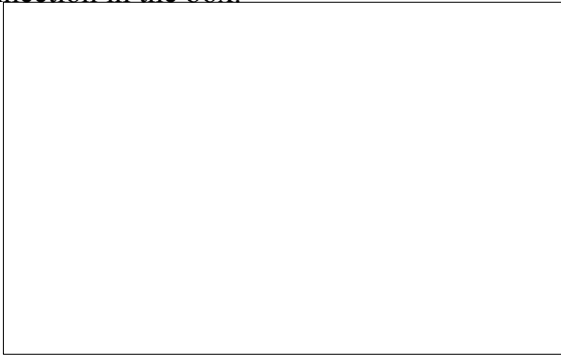
$I_2 =$ _____ $I_1 + I_2 =$ _____ % difference from I_T _____

Now we will connect the bulbs in series

Disconnect all of your leads from the circuit except for the single black lead that connects your two bulbs. Connect a black lead to the unconnected side of bulb 1 and a red lead to the unconnected side of bulb 2. This sets up your bulbs in series with each other (since they only touch on one side and current will flow through one and then the next.) Draw a circuit diagram for this connection in the box.

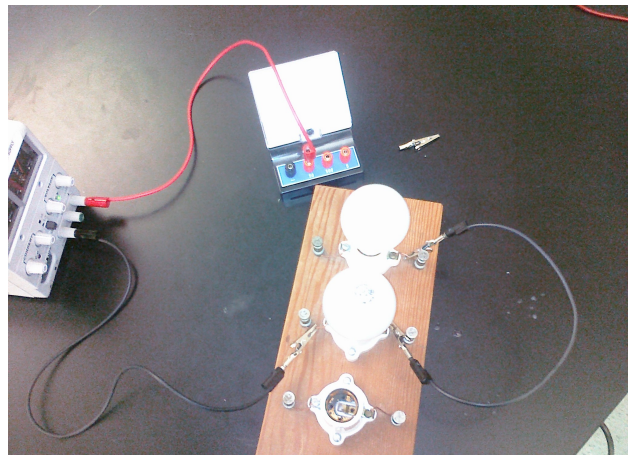


Connect the black lead to the negative terminal of the power supply and the red lead to the positive terminal of the power supply. Draw a circuit diagram for this connection in the box.

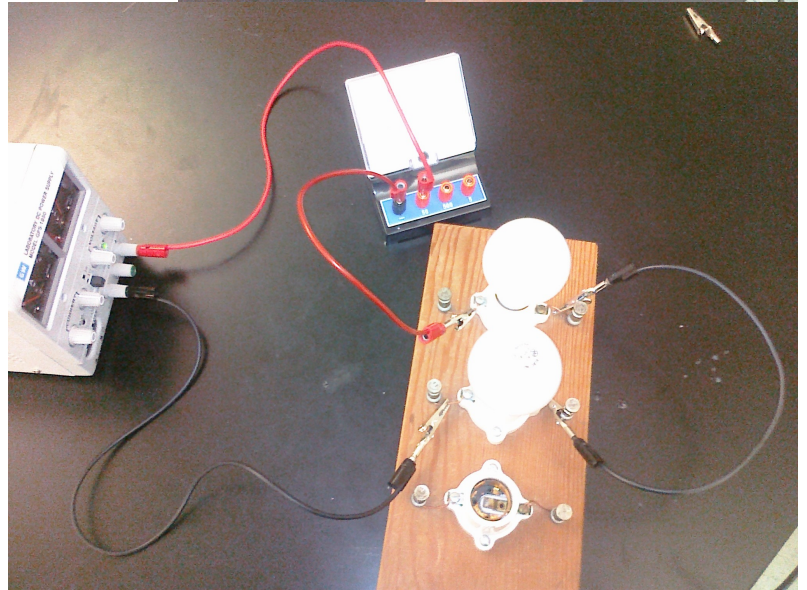
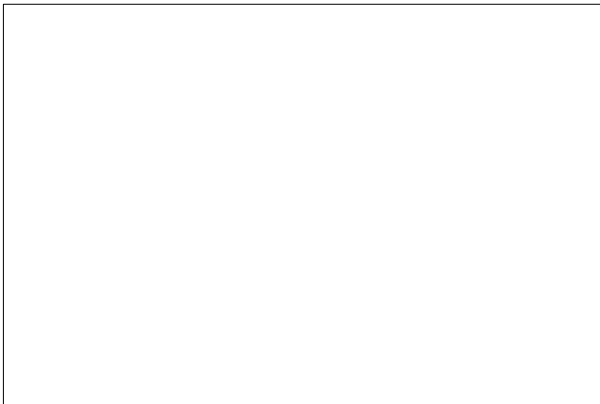


Do the bulbs light up? Are they brighter or darker than when connected in parallel?

Remove the positive lead coming from the power supply from the bulbs. Connect it instead to a positive terminal of the ammeter.



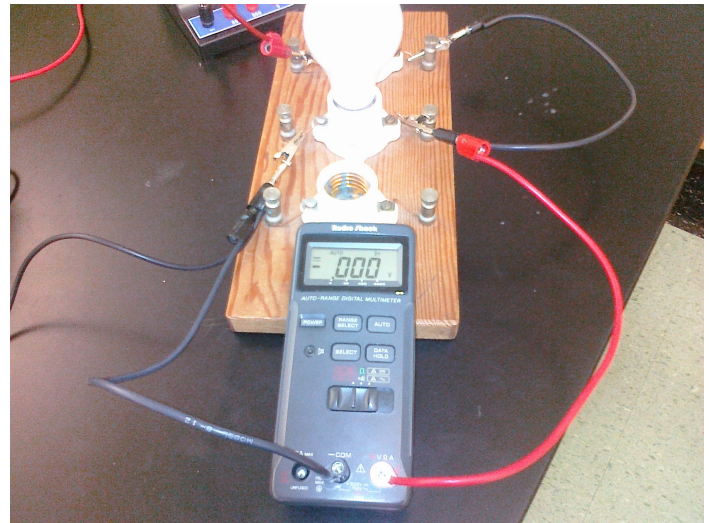
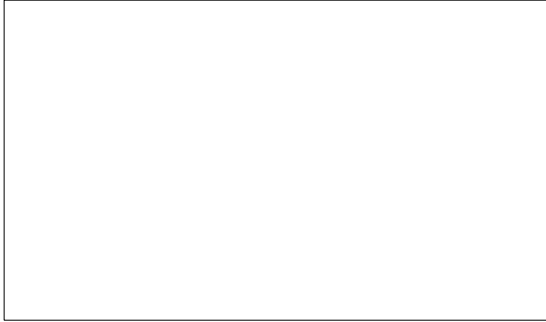
Connect the negative end of the ammeter to bulb 2. This causes the current to go through the ammeter first before entering the bulbs. Draw a circuit diagram for this connection in the box. What is the total current in the circuit?



$I_T =$ _____

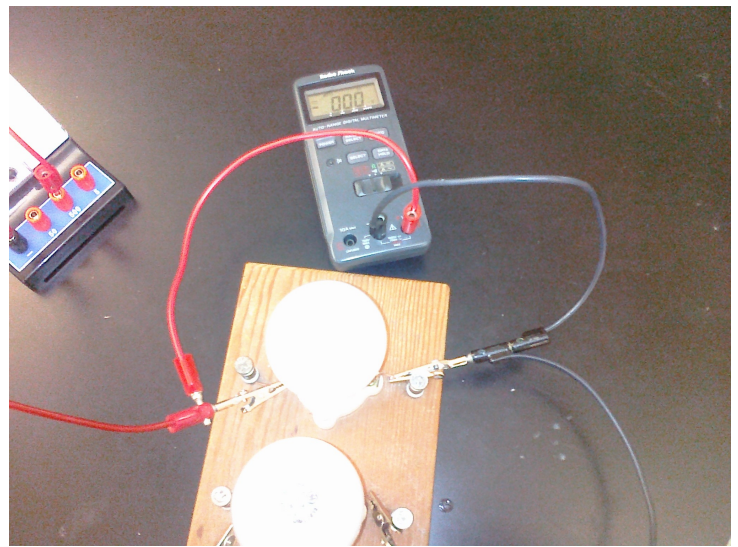
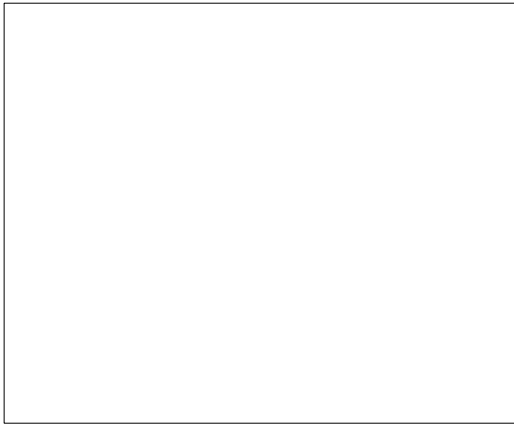
Is I_T larger when bulbs are connected in series or parallel? Why? How does the current relate to the brightness of the bulbs?

Measure the voltage of bulb 1 by connecting the voltmeter across bulb 1.



V1= _____

Do the same for bulb 2



V2= _____

V1+V2= _____

What is the same for two resistors connected in series?

What is the same for two resistors connected in parallel?

When in series, what does the sum the voltage of two resistors add up to?

When in parallel, what does the sum of the current of two resistors add up to?