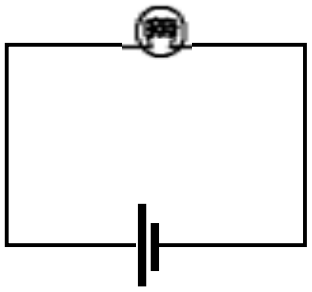
Simple Circuits

In this lab activity, you will study some very simple electrical circuits, using light bulbs as the resistive elements. The light bulbs offer the advantage of "seeing" the current, that is, at least in terms of the brightness of the bulb, which will help you observe what is going on. Quantitative measurements will be made of the potential difference across various elements with a voltmeter and of total current in the circuit with an ammeter.

To provide power to your circuits, use the FIXED +5 V output on the left side of your power supply. Please note that you are responsible for measuring every inch (or millimeter!) of your circuit, including bulbs and wires (which are not ideal conductors in this reality!). You need to verify that all voltages add up properly around a complete circuit loop (following Kirchhoff's Law).

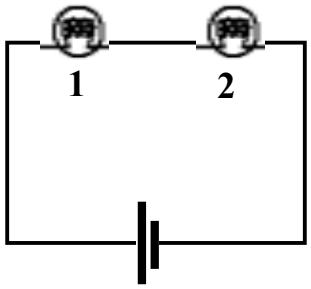
I. Single bulb

Set up a circuit with a single light bulb. Measure all voltages that you can and put them into a table. Do the voltage values make sense, relative to the output of the power supply? Note the brightness of your bulb for future reference. Use an ammeter to determine the total current coming out of the power supply.



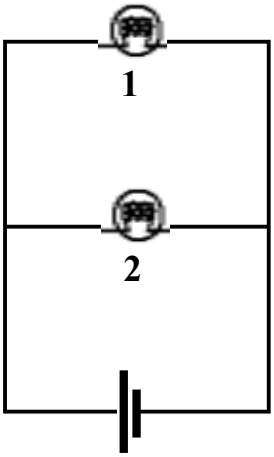
II. Two bulbs in series

Set up a circuit with a two light bulbs in series. Measure all voltages that you can and put them into a table. Do the voltage values make sense, relative to the output of the power supply? What about the voltage drops across each bulb? How does the brightness of your bulbs compare with the case of the single bulb? Unscrew one of your bulbs for a moment – what happens to the rest of the circuit? Use an ammeter to determine the total current coming out of the power supply.

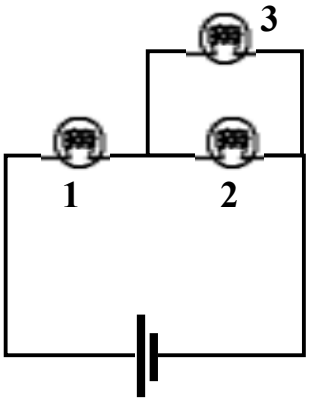


III. Two bulbs in parallel

Set up a circuit with a two light bulbs in parallel. Measure all voltages that you can and put them into a table. Do the voltage values make sense, relative to the output of the power supply? What about the voltage drops across each bulb? How does the brightness of your bulbs compare with the single bulb, or the series bulbs? Unscrew one of your bulbs for a moment – what happens to the rest of the circuit? Use an ammeter to determine the total current coming out of the power supply.

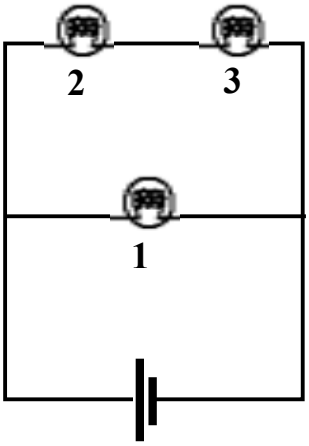


IV. Three bulbs in series and parallel (config. #1)



Set up the circuit with two bulbs in series, and then add a parallel path around one of the bulbs with another light bulb (shown as bulb #3 in the figure) and a switch. Observe carefully what happens when you close the switch. Open and close it several times to watch the effect, and describe the brightness of each bulb carefully. With the switch closed, make your full survey of voltage measurements, and also determine the current coming out of the power supply with an ammeter.

V. Three bulbs in series and parallel (config. #2)



Set up the circuit with two bulbs in series, and then add a parallel path across both of the bulbs with another light bulb (shown as bulb #1 in the figure) and a switch. Observe carefully what happens when you close the switch. Open and close it several times to watch the effect, and describe the brightness of each bulb carefully. With the switch closed, make your full survey of voltage measurements, and also determine the current coming out of the power supply with an ammeter.

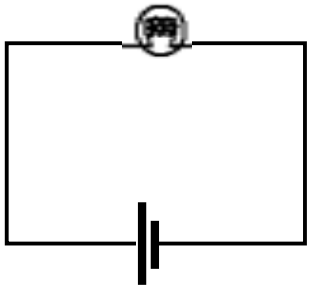
You should analyze each circuit thoroughly, which means evaluating all voltage drops and comparing them to what you predicted. Also, you should compare your total current (from the battery) to your prediction, based on the power supply voltage and the resistances of the light bulbs. All numerical results should be explained, and all observations (brightness of light bulbs) should be discussed in your lab report.

Simple Circuits Predictions

Predict the voltages across each bulb shown in the various circuits below. You should take the battery voltage to be 3 V and the light bulb resistance to be 3 Ω. Also make a prediction of the total current coming out of the battery.

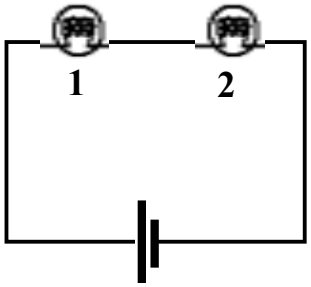
I. Single bulb

V_{bulb}	V_0
Brightness	B_0



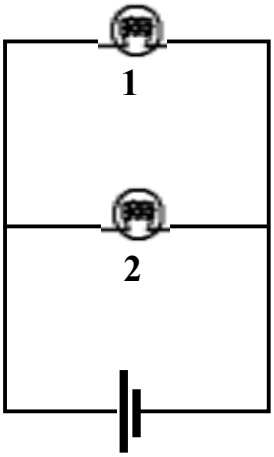
II. Two bulbs in series

Quantity	Predicted	Measured
V_1		
V_2		
Brightness relative to B_0		

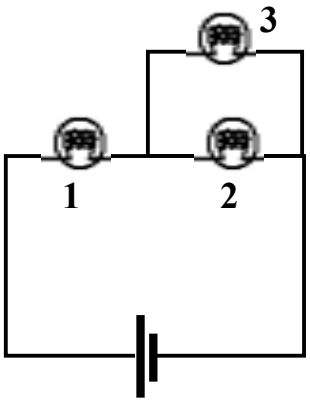


III. Two bulbs in parallel

Quantity	Predicted	Measured
V_1		
V_2		
Brightness relative to B_0		

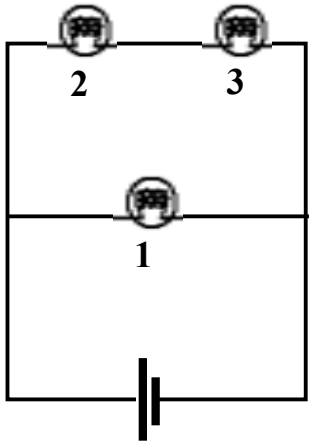


IV. Three bulbs in series and parallel (config. #1)



Quantity	Predicted	Measured
V_1		
V_2		
V_3		
Brightness relative to B_0		

V. Three bulbs in series and parallel (config. #2)



Quantity	Predicted	Measured
V_1		
V_2		
V_3		
Brightness relative to B_0		

Names of group members: _____

_____

_____