Electrical Measurements

As you work through the steps in the lab procedure, record your experimental values and the results on this worksheet. Use the exact values you record for your data to make later calculations.

Measurement of Voltage

Record the voltage readings on the multimeter (including sign) and the reading on the power supply's meter.

Record the differences when the positive and negative leads are **switched at the multimeter**.

Record the voltage reading on the multimeter (including sign) when the positive and negative leads are **switched at the power supply**. Explain the significance of the sign changes in the DC voltage when the leads were interchanged.

Record the voltage of the battery (D cell).

Switch the leads and record the voltage.

Explain the significance of the sign changes in the DC voltage when the leads were interchanged.

Record the AC voltage of the transformer.

Switch the leads and record the AC voltage on the multimeter.

Is there a sign associated with the AC voltage?

Resistors (Linear (Ohmic) Device)

Complete the table.

Table 1

Voltage (V)	**Current (A)**
1	
2	
3	
4	
5	

Find the slope and the intercept of the best fit to your data.

From your data, calculate R for your 700 Ω resistor.

From your data, would you deduce that the resistor is a linear device? Explain.

Light Bulbs (Nonlinear Device)

Checkpoint 1: Have your TA check your diagram before moving to the next step.

With one of the banana leads attached to the positive terminal of the power supply, record whether or not the bulb lights up.

Record the voltage and the current (if any) from the power supply's meter.

With both of the banana leads connected to the bulb and to the positive terminal of the power supply, record whether or not the bulb lights up.

Record the voltage and current (if any) from the power supply's meter.

With one of the banana leads connected from the bulb to the positive terminal and the other from the bulb to the negative terminal of the power supply, record whether or not the bulb lights up.

Record the voltage and current (if any) from the power supply's meter.

With the banana plug leads reversed at the light socket base, record the voltage and the current.

What happened to the light bulb? Is the voltage and current different from the ones before the leads were switched at the light socket base?

Checkpoint 2: Have your TA check your circuit before moving to the next step.

Complete the table.

Table 2

Voltage (V)	**Current (A)**	$R = V/I$ **(Ω)**
2		
4		
6		
8		
10		
12		

You will upload your graph of this data at the end of the lab.

Resistance of Various Materials

Record the multimeter reading.

Compare this reading with the result determined by the inverse slope of your graph, and with the nominal value of 700 Ω.

Complete the table. List the materials and their resistance in order of **increasing** resistance. For graphite and your body, where you are making more than one measurement for the material, record only the result with the lowest resistance in the table.

Table 3

	Material	**Resistance (Ω)**
1		
2		
3		
4		
5		
6		
7		
8		

Resistors in Series

Record the resistance of the combination with the multimeter set in the Ohm position.

With the multimeter, measure and record the potential differences ΔV_{150} and ΔV_{700} across each resistor, and the voltage difference ΔV across the combination.

Does $\Delta V = \Delta V_{700} + \Delta V_{150}$ or $\Delta V = \Delta V_{700} = \Delta V_{150}$ better represent your data?

Checkpoint 3:	Have your TA check that you have the correct setup before moving to the next step: a fuse may blow if the meter is not connected to the proper points in the circuit.

Complete the table.

Table 4

Voltage (V)	**Current (A)**
5	
2	
4	
6	
8	
10	
12	

You will upload your graph of this data at the end of the lab.

Find the slope of the straight line that best fits your data and record your result, including units.

Calculate the equivalent resistance R_S of the two resistors in series, in units of ohms (Ω).

How does this compare to the value of the two resistors used in this series circuit?

Resistors in Parallel

Record the measured resistance of the 150 and 700 Ω resistors in parallel.

Record the voltage difference across each resistor and across the combination.

Does $\Delta V = \Delta V_{700} + \Delta V_{150}$ or $\Delta V = \Delta V_{700} = \Delta V_{150}$ better represent your data?

Checkpoint 4:	Have your TA check that you have the correct setup before moving to the next step: a fuse may blow if the meter is not connected to the proper points in the circuit.

Measure and record the currents I_{150} and I_{700} flowing through each resistor and the total current I flowing through the power supply.

Does $I = I_{150} + I_{700}$ or $I = I_{150} = I_{700}$ better represent your data?

Checkpoint 5:	Have your TA check that you have the correct setup before moving to the next step: a fuse may blow if the meter is not connected to the proper points in the circuit.

Complete the table.

Table 5

Voltage (V)	**Current (A)**
2	
4	
6	
8	
10	
12	

You will upload your graph of this data at the end of the lab.

Find the slope of the straight line that best fits your data and record your result, including units.

Calculate the equivalent resistance R_{p} of the two resistors in parallel, in units of ohms (Ω).

How does this compare with the result described in the lab introduction for adding two resistors in parallel?

Upload Files

Upload your graph of the data from Table 2. (Submit a file with a maximum size of 1 MB. *You will upload this file in the WebAssign question.*)

Upload your graph of the data from Table 4. (Submit a file with a maximum size of 1 MB. *You will upload this file in the WebAssign question.*)

Upload your graph of the data from Table 5. (Submit a file with a maximum size of 1 MB. *You will upload this file in the WebAssign question.*)