Name _____ Date _____

Partners _____

DC Circuits: Lab #6
M.L. West

Objective: to become familiar with components in direct current circuits.

Equipment: (Add to the list as equipment is given to your group.)

Definitions, in words (and some equations):
Electrical circuit:

EMF:

Voltage:

Current:

Resistance:

Light bulb:

Ohm's Law:

Equivalent resistance in a series circuit:

Equivalent resistance in a parallel circuit:

Procedure:
1. Getting Started
Draw four different arrangements of connecting a battery, a light bulb, and a single wire. Draw the objects as they appear, not a circuit diagram.

Now try each one and mark whether the light lit or not. At least one should work.

2. Lightbulb
Examine a light bulb. Sketch it, including its electrical components.

3. Flashlight
Examine a flashlight carefully and sketch the flashlight's parts. Also sketch the circuit diagram when the light is on.

How many wires are used to make this circuit? _____

4. Resistors
Most resistors have their value in ohms written on them in a color band code rather than in numbers. Can you guess why?

For each of five resistors record its color code and the meaning.
The color code is interpreted as:
black = 0, brown = 1, red = 2, orange = 3, yellow = 4, green = 5, blue = 6, violet = 7, gray = 8, white = 9
Reading from the color band closest to the end of the resistor:
tens, units, power of ten, tolerance (none = 20%, silver = 10%, gold = 5%)
For example, yellow violet orange silver = 4, 7, 3, 10% = 47 x 10^3 $\pm$ 10% = 47 k ohms $\pm$10%

Now measure the resistance of each resistor with the meter, and calculate the percent difference from the color-labeled value. For each resistor you should first set the meter's resistance scale to a maximum number just above the resistor you are trying to measure. Change scales on the meter for each resistor, if needed.

Colors	Interpretation	Measured ohms	Percent diff.	Within the tolerance?

Does a resistor have a direction? (i.e., is its value in ohms a scalar or a vector?)
How did you decide?

5. Simple Circuit
Record the EMF value written on your battery _____volts.
Change the meter's scale to read this number of volts, and measure the voltage of your battery.
$V_{measured}$ = _____ volts.
Does a battery have a direction (is its value in volts a scalar or a vector)?
How did you decide?

Draw a circuit diagram with a battery, resistor, and an ammeter (current meter).

Place one of your resistors into such a circuit. (Please wait to connect the battery last and briefly so as not to wear it down prematurely.)
Measure the DC current using the meter's milliamp (mA) scale.
Calculate the expected voltage (V = I*R) and calculate your % difference from the measured value.
Try another resistor.

R, measured above, ohms	I, current measured, mA	V, battery measured above, volts	V, calculated as V=I*R, volts	% difference from $V_{measured}$

6. Circuit with resistors in series
Draw a diagram of a circuit with two of your resistors (both less than 1000 ohms) in series.

Calculate the equivalent resistance: $R_{equivalent}$ =
Wire this circuit.
Connect your battery to these two resistors (call them R1 and R2) in series and measure the current in the circuit.
Compare the calculated equivalent resistance to your experimental result (R = V/I)
Try another combination of resistors.

R1, ohms	R2, ohms	V battery measured, volts	I, current measured, mA	R, calculated as V/I	R, calculated as $R_{equivalent}$	% diff of R calc and R equiv.

7. Circuit with two resistors (less than 1 k) in parallel
Diagram of circuit:

Connect your battery to two of your resistors in parallel and measure the currents through the circuit.
Calculate the equivalent resistance: $R_{equivalent}$ =
and compare it to your experimental result.

R1, ohms	R2, ohms	V battery measured, volts	I, current measured, mA	R, calculated as V/I	R, calculated as R equivalent	% diff of R calc and R equiv.

If there is time, try three resistors in series, and also three resistors in parallel.

Conclusions:

Discussion of errors:
Just as the resistance for a light bulb changes when the light bulb goes from a resting state to an operating state, perhaps the voltage of a battery also changes when it goes from a resting state to an operating state. Design a way to test this idea. Try it. By what percent did the voltage of the battery change under a load?

Applications to your life: