

## Simple Circuits Spring 2004

### Introduction

In this experiment, you will practice connecting simple circuits containing a single light bulb. The *voltage across* and the *current through* the bulb will be measured, and circuit diagrams will be created. *Safety note:* always connect your wires to the power supply after your components are connected; never leave bare wires hanging from the power supply.

1. You will be using two identical multimeters, one labeled as an *ammeter* (for measuring current), the other a *voltmeter* (for measuring voltage). It is important that each meter is connected correctly to the circuit, to prevent blowing a fuse in the meter or power supply.
  - a. The voltmeter measures the *voltage across* a component (light bulb, battery, etc.); insert *two* wires into the voltmeter, one in the “COM” port, the other in “V/ $\Omega$ ”. This will remind you that the voltmeter is used to “touch” both sides of a component.
  - b. The ammeter measures the *current through* the circuit, and gets inserted into the circuit just like another component. Insert *one* wire into the ammeter in the “A” port. This will remind you that the circuit needs to be opened up in order to measure current (the “free” wire from the opened circuit will be connected to the “COM” port).
2. **1.5 VOLT DC SOURCE:** You *won't* get a shock from a 1.5-volt battery unless you put it in your mouth (**not a recommended procedure!**).
  - a. Light the bulb: Holding a piece of wire, a *dc* bulb and a battery in your hands, make a closed circuit and light the bulb. Each partner should do this. Create a *rough* sketch of the circuit in your report.
  - b. An easier arrangement: Connect the battery holder and bulb socket with wires to make the same circuit as in (a), then use a battery to light a bulb. Try some other bulbs. Sketch the circuit using the *conventional* symbols shown below.



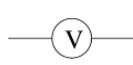
DC Battery  
(single cell)



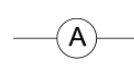
DC Battery  
(double cell)



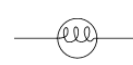
AC Voltage



Voltmeter



Ammeter



Bulb

- c. Turn the voltmeter on and set it for DC voltage. Measure **V**, the *voltage across* the battery, by connecting the meter probes across the bulb connections. This will be the same as the battery voltage when a bulb is connected; check it by touching the meter probes to both sides of the battery (while the bulb is still connected).
- d. **I**, the *current through* the bulb, is measured by “inserting” the ammeter in a wire between the battery and the bulb as follows: disconnect *either* bulb wire from the battery and attach the free end to the “COM” terminal on the ammeter; complete the circuit with the wire you previously connected to the “A” terminal. If the meter reads backwards, switch the leads. Sketch the circuit (using conventional symbols) that you have assembled.
- e. Set up a data table with four columns to record the following information: the code number of the bulb; the battery voltage; the bulb current; and the power output. Record the current and voltage for 3 or 4 bulbs.
- f. *Power*. The power, in Watts, is the product of the voltage across the bulb (volts) and the current through it (amperes). In the last column of your table, calculate the power for each bulb.

3. *120 VOLT AC SOURCE*: You *will* get a shock from 120 volts, so be sure to **turn the voltage to zero, and turn the power off with the switch each time you make a change to your circuit.**
- Wire an *AC* bulb socket to the AC voltage source, screw in a light bulb and try it out.
  - Turn the power off*, then ‘insert’ the *AC* ammeter by **replacing** one of the bulb wires with the ammeter and its wires. Your instructor will show you which terminals to use and how to read the scale. Connect the same multimeter used previously across the light bulb, but set it to read *AC* voltages (Circuit power is *still* off!!).
  - Set the voltage to zero, turn on the switch, and raise the voltage **slowly** until the **voltmeter** reads the voltage rating on the bulb (110 to 125 v). Sketch the circuit using conventional symbols, a create a new table with columns for the bulbs rated wattage, voltage, current, power output, and the percent difference between the measured and rated bulb wattage. Measure voltage, current and power output for four or five different bulbs. In each case, set the voltage to the rating on the bulb, then measure the current. Be careful; the bulbs get hot!

### Discussion

- You will be graded on your circuit diagrams and data table. A discussion is not required since the purpose of this lab is to learn how to connect circuits. You *should* comment on the measured power output of the bulbs as compared to their expected values.
- Feel free to experiment with various types and numbers of bulbs and batteries. **Note:** A large wattage bulb (~300W) is available for testing – be sure to use the *ammeter* provided!