Current -Voltage Characteristics of Sources

The purpose of this lab is to explore real source in circuits. In this lab we will explore a chemical cell (standard battery), a current limited voltage source and a photovoltaic panel. These examples illustrate some models used to characterize sources in electrical circuits.

Procedure

For all sources, a variable load will be connected to the source, with an ammeter in series with the load and a voltmeter in parallel with the load (as shown below). Simultaneous values of the voltage across the load and the current through the load will be made as the load resistance is varied from high resistance (open circuit, 100's of kΩ) to "low" resistance (i.e. values of $R_L$ that will produce voltages that are a small fraction of the open circuit voltage).

For all sources:

Start with an open circuit (infinite resistance), which can be obtained by disconnecting one end of the load resistance. As always, record the current and voltage using the highest resolution settings possible for the meters. Decrease the load resistance to get a range of voltage readings (down close to zero).

Use the spreadsheet provided to graph current versus voltage as well as power (where $P = I \times V$) versus voltage.
Sources:

Current limited battery.

This source consists of a single 1.5 V battery placed in series with a 1 kΩ resistor.

Real Old battery.

This source consists of a single 1.5 V which acts somewhat as like an ideal EMF and a series internal resistance. Be careful to disconnect the battery between readings, as the drainging of the battery will change the internal resisitance over the course of the experiment.

Solar Cell

Analyze this source under at least two different lighting conditions (e.g. class room lighting and full sun). If time permits try hooking two panels in series/parallel as a "single source".
Equivalent Circuit for a real battery or a current limited voltage source.

Equivalent Circuit for a solar panel. Note the diode is a real diode with a characteristic current voltage curve, not an idealization of zero resistance for current in one direction and infinite for the other direction.