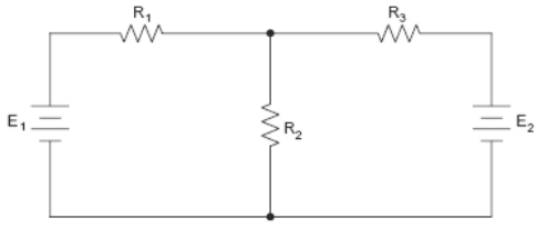
PASCO's SPARK Science Learning System and Hypothetical Inquiry

Wenning in his 2005 article **Levels of inquiry: Hierarchies of pedagogical practices and inquiry processes**, *Journal of Physics Teacher Education Online,* 2(3), February 2005, pp. 3-11 (see http://www.phy.ilstu.edu/pte/publications/) describes various approaches to be used in inquiry-oriented instruction. (Be certain to read and understand "Measuring Metrically" in the Student Laboratory Handbook before beginning this exercise.)

The most advanced form of instructional practice addressed in his Inquiry Spectrum is hypothetical inquiry. In this activity you will use the approach of applied hypothetical inquiry to address the actual workings of a "complex" electrical circuit.

Construct the following electrical circuit using the cells, cell holders, resistors, and wires provided. The electromotive force (EMF) of no battery should more than 5 volts.



Using a multimeter, determine the resistance of each resistor and the voltage that the battery provides to the completed circuit.

Using your knowledge of conservation of energy and conservation of charge in an electrical circuit (ideally obtained from a study of equivalent resistances for series and parallel resistors, e.g., $V_{total} = V_1 + V_2 + V_3 + \ldots$ and $I_{total} = I_1 + I_2 + I_3 + \ldots$), PREDICT – using any rational system you choose – the current through and voltage drop across each of the resistors in the circuit.

Using the SPARK system provided, determine the actual values of current through and voltage drop across each of the parts in the circuit. Record all data in the cells below. (Measure voltage drop across a resistor by configuring your voltage probe in **parallel** with it; measure current through a resistor by configuring your amperage probe in **series** with it.)

Part	Voltage Drop Predicted	Voltage Drop Observed	% Error*	Current Predicted	Current Observed	% Error*
R_1						
R_2						
R_3						

* Recall that percent error is defined as follows: $100*|P - O|/P$ were P is the predicted value and O is the observed value. If the percent error between predicted versus experimental value is greater than 1%, revise your hypothesis, make new predictions, and compare with the observed values.