Kirchhoff's Rules[1]

Equipment Needed:

1 Circuits Experiment Board	Demo Cart
1 Power Supply	Demo Cart
1 Multimeter	Demo Cart
5 Resistors (100Ω to 600Ω)	Demo Cart

Purpose

The purpose of this lab will be to experimentally demonstrate Kirchhoff's Rules (the Loop Rule and the Junction Rule) for electrical circuits.

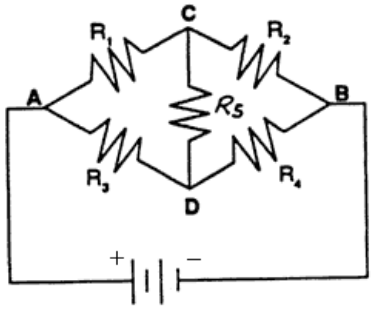

Figure 1: Schematic and Wire Diagram

Procedure

1. In choosing your resistors, make sure the ratio $\frac{R_1}{R_2}$ does NOT equal $\frac{R_3}{R_4}$, otherwise you may have no current passing through R_5.
2. Connect the circuit shown in Figure 1 using the resistors listed below Figures 1. Use Figure 1 as a reference to wire the circuit and as you record your data. Record the resistance values in Table 1. With no current flowing (the power supply disconnected), measure the total resistance of the circuit between points A and B.
3. Turn **ON** your power supply and adjust for 1.5 to 2.0V.

[1]Adapted from PASCO Basic Electricity ©1993, PASCO Scientific Roseville, CA

Table 1: Trial and Data

Resistance (Ω)	Voltage (V)	Current (mA)
R_1	V_1	I_1
R_2	V_2	I_2
R_3	V_3	I_3
R_4	V_4	I_4
R_5	V_5	I_5
R_t	V_t	I_t

4. When the circuit is connected to the power supply, measure the voltage across each of the resistors and across the power supply (V_t). Record the values in Table 1.

5. On the circuit diagram, Figure 1, indicate which end of each of the resistors has a higher potential than the other end by placing a "+" at that end. Which side has a higher potential could be determined by the sign of the voltmeter, which gives the value of $V = V_{red} - V_{black}$ (the potential of the red lead minus the black lead). This is a very important step, without this step it will be impossible to do your data analysis later on. When you submit your work next week, include the circuit diagram with the five "+" on the diagram, one for each resistor.

6. Now measure the current through each of the resistors. Interrupt the circuit and place the DMM in series, with each resistor, to obtain your reading. Make sure you record each of the individual currents, as well as the current flow into or out of the main part of the circuit, I_t.

Analysis

1. Determine the net voltage change ΔV around at least three of the closed loops. Remember, if the potential goes up, treat the voltage change as positive (+). If the potential goes down, treat it as negative (−). Draw a diagram for each case to show the loop you are using to calculate ΔV (so you should have three diagrams, and three

ΔV, one for each loop). Kirchhoff's Loop Rule states that your ΔV should be zero (or close to zero experimentally).

2. Complete Table 2 to check that Kirchhoff's Junction Rule is satisfied at all four nodes, i.e., the current going into a junction should equal that going out.

Table 2: Kirchhoff's Junction Rule

Node	I_{in}	I_{out}	Percentage Difference	$\Delta I = I_{in} - I_{out}$
A				
B				
C				
D				