OL-37 Combination of Series and Parallel Circuit Using PhET Simulation

Objective

1. Learn to build a combination of series and parallel circuit with three resistors.
2. Use the PhET interactive simulation tool (Circuit Construction Kit AC Prototype) to build the circuits and to verify Ohm's Law.

Theory

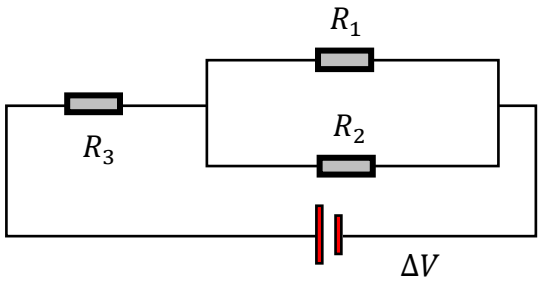

Figure 1 Two resistor in series

$$\frac{1}{R_{12}} = \frac{1}{R_1} + \frac{1}{R_2} \quad (1)$$

$$I_{12} = I_1 + I_2 \quad (2)$$

$$\Delta V_{12} = \Delta V_1 = \Delta V_2 \quad (3)$$

$$R_{total} = R_{12} + R_3 \quad (4)$$

$$I_{total} = I_{12} = I_3 \quad (5)$$

$$\Delta V = \Delta V_{12} + \Delta V_3 \quad (6)$$

Equipment

PhET interactive simulation tool (Circuit Construction Kit: DC - Virtual Lab)

https://phet.colorado.edu/en/simulation/circuit-construction-kit-dc-virtual-lab

Procedures

Build the circuit as shown in Figure 1 by using the PhET Simulation Tool. See OL-00 PhET Simulation Tool Instructions for Electric Circuit Labs for details on how to set up the circuit.

1. Using PhET Simulation Tool, build a combination of series and parallel circuit by using **three resistors** as shown in Figure 2. $R_1 = 50\ \Omega$, $R_2 = 80.0\ \Omega$, $R_2 = 20.0\ \Omega$, $\Delta V = 5.0\ V$

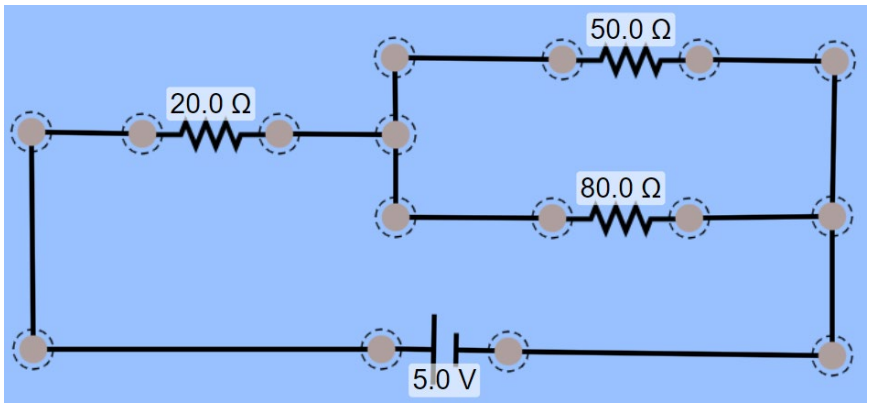

Figure 2

2. Measure the voltages across each resistor, and the voltage across both resistors R_1 and R_2 (resistor R_{12}). Record the values on the table 1.
3. Using Ohm's Law, calculate the currents for each resistor and put the values on Table 1.
4. Using the Ammeter tool, measure the current passing through each resistor, and the current going through both R_1 and R_2 (resistor R_{12}). Record the values on Table 1. Note that the Ammeter should be in series with the resistor.
5. Calculate the theoretical current values for each resistor using equations 1, to 6 and put the values on Table 1.
6. Compare the measured current in column 3 and theoretical current in column 4 and find the percentage error.

Data Table 1

	1	2	3	4	5
	Measured Voltage	Calculated Current (Using Ohm's Law)	Measured Current	Theoretical Current (Using Equation 1-6)	% error (compare column 3 and 4)
20 Ω					
50 Ω					
80 Ω					
R_{12}					