Ohm's Law

Objective: Design a step-by-step experiment procedure to study Ohm's law

Introduction:

Ohm's law states that,

$$V = IR$$

Where V. I, and R represent the voltage in volt, current in ampere, and resistance in ohms, respectively, for a resistor or segment of DC circuit. R is the equivalent resistance if the segment consists of multiple resistors.

Experiment requirement:

Every group will be provided the same equipment as last week including the resistors drawers, a circuit board, cables, and two mulitmeters.

Build a circuit according to the diagram in figure 1 using resistors with nominal values as R1=100Ω, R2=220Ω, R3=1kΩ, R4=2.2kΩ, and R5=1kΩ. A power supply should be connected to points A and B. Vary the voltage setting on power supply from 10 to 20V with at most 1V increment. Choose three different components/segments (at least one from each category in Lists 1 and 2). From these three components/segments, each group member pick one and measure the relevant variables to produce a data table and/or plots to show if the Ohm's law is satisfied (or not).

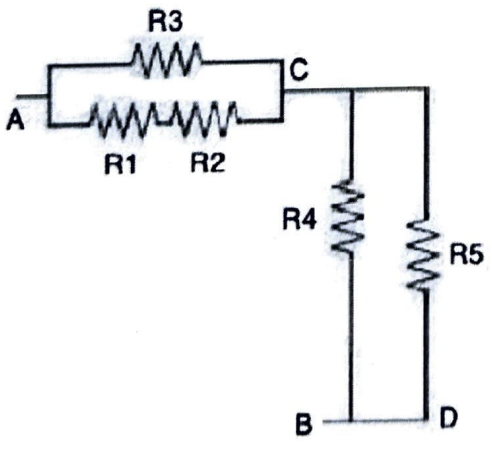

Figure 1. Circuit diagram.

List 1

Components:

R1, R2, R3, R4, and R5

List 2

Circuit segments:

AB, AC, CB

Precaution: pick a dedicated mutlimeter as an ammeter and fix its scale to 200mA. This will avoid a multimeter from switching between ammeter and voltmeter, which can easily blow the fuse. Use the other multimeter when measuring resistance and voltage.

Lab report requirement:

State your procedure clearly. Describe data analysis including uncertainties. Include enough details in your data table(s) and plots. Cite your data and plots to support your conclusion.

Hint:

1. You can use measured R and I to calculate V, then compare it with measured V, or
2. You can fit V vs. I plot with linear function, then compare the slope (should be R) with the measured R.

These are two common approaches, but you are not limited to them. For whichever approach you pick, make sure you understand the uncertainties involved.