Lab1: Voltage and Current Sources

A. Objective

The objective of this experiment is to achieve a stiff voltage source and a current source, which will be investigated.

B. Instruments and Materials

1 Power supply: adjustable to 10V, 6 ½W resistors: 56Ω, 200Ω, 470Ω, 2.2kΩ, and DMM (digital multimeter).

C. Circuit testing

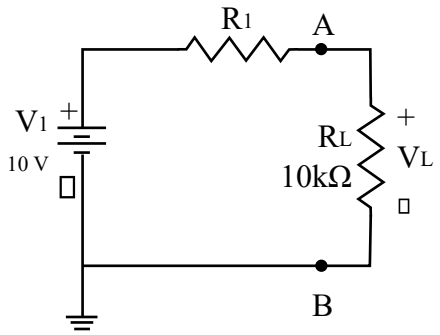

Figure 1

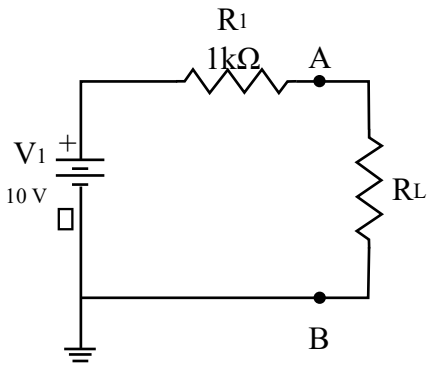

Figure 2

D. Experimental Procedure

Voltage source

- The circuit left of AB terminals in Figure 1 represents a voltage source and its internal resistance R_1. Before measuring any voltage or current, the approximate value should be known so that the test equipment can be set to the proper range. Examine Figure 1 and estimate and record the load voltage for each value of R_1 listed in Table 1. It is important to be able to estimate these rough values and to be able to calculate exact values.
- Sketch the circuit in Figure 1. Measure and record the value of each of the resistors used in this experiment. Build the circuit in Figure 1 using the values of R_1 given in Table 1. Measure and adjust the source voltage to 10 V. For each R_1 value, measure and record V_L in Table 1.

Current source

- The circuit left of the AB terminals in Figure 2 acts like a current source under certain conditions. Estimate and record the load current for each value of load resistance shown in Table 2.
- Sketch the circuit in Figure 2. Build the circuit of Figure 2 using the R_L values given in Table 2. Measure and adjust the source voltage to 10 V. For each R_L value, measure and record I_L in Table 2.

Experiment 01

Resistor (Ω)	Measured Value
56	56.1
200	198.1
470	460.2
10k	9.49k
2.2k	2.1k

Table 1: VOLTAGE SOURCE

R_1 (Ω)	Estimate V_L(V)	Measured V_L(V)	
		Multisim	Actual
56	9.94		9.94
200	9.8		9.8
470	9.55		9.55
2.2k	8.19		8.17

. Formula for calculate: $V_L = \frac{R_L}{R_1+R_L} \times V$

Table 2: CURRENT SOURCE

R_L (Ω)	Estimate I_L(A)	Measured I_L(A)	
		Multisim	Actual
56	0.0046		4.4
200	0.00414		4.10
470	0.00379		3.73

. Formular for calculate: $I_L = \frac{V}{R_1+R_2}$

Questions

1. The data of Table 1 prove that load voltage is:
   ☐ Perfectly constant; ☐ small; ☐ heavily dependent on load resistance; ☐ approximately constant
   - **Answer**: Heavily dependent on load resistance.
2. When internal resistance R_1 increases in Figure 1, load voltage:
   ☐ increases slightly; ☐ decreases slightly; ☐ stays the same.
   - **Answer**: decreases slightly.
3. The circuit left of the AB terminals in Figure 2 acts approximately like a current source because the current values in Table 2:
   ☐ increase slightly; ☐ are almost constant; ☐ decrease a great deal; ☐ depend heavily on R_L
   - **Answer**: increase slightly.