Number:
Name Surname:
Department:

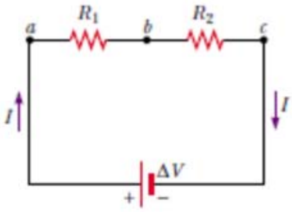
EXPERIMENT 2

1. RESISTORS IN SERIES

Theoretical Background

If two or more resistors are connected in such a way that the same current flows through them, these resistors are said to be in series. In Figure-a, the current passing through the resistors is same. The equivalent resistance for two or more resistors connected in series;

Figure- a



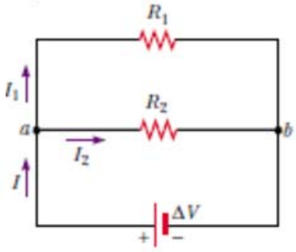
$$R_{eq} = R_1 + R_2 + R_3 + \cdots$$

is written as above.

If two or more resistors are connected as in Figure-b, this connection type is called parallel connection. In this case, the potential difference between the ends of each resistor is the same. The current flowing from the main branch branches off at the nodal point. The sum of the currents flowing through the branches is equal to the current flowing through the main branch. Equivalent resistance when two or more resistors are connected in parallel;

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \cdots$$

Figure- b



The instrument that measures current is called ammeter. The current to be measured must pass directly through the ammeter. Therefore, the ammeter is connected in series with the branch on which the current is desired to be measured. An ideal ammeter has zero internal resistance, but in reality such an ammeter cannot be made. The smaller the internal resistance value, the more accurate the reading.

The instrument that measures the potential difference is called a voltmeter. If the potential difference between the ends of the circuit component in the circuit is desired to be measured, the voltmeter is connected in parallel with that circuit component. Voltmeters are designed to have very large internal resistances (in the order of MΩ) in order not to draw current..

***ATTENTION ***

During the experiment, set the multimeter indicated with the letter V at the 20V range. Set the multimeter with the letter A and voltmeter on it as an ammeter at 200mA. Use devices at these settings throughout the entire experiment. *DO NOT CHANGE.*

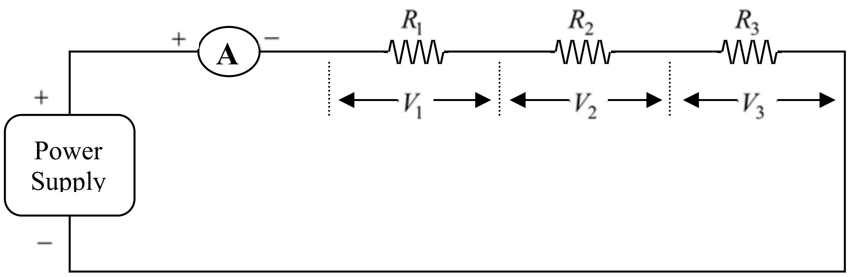
EXPERIMENT 1. Experimental Finding of Resistance Values

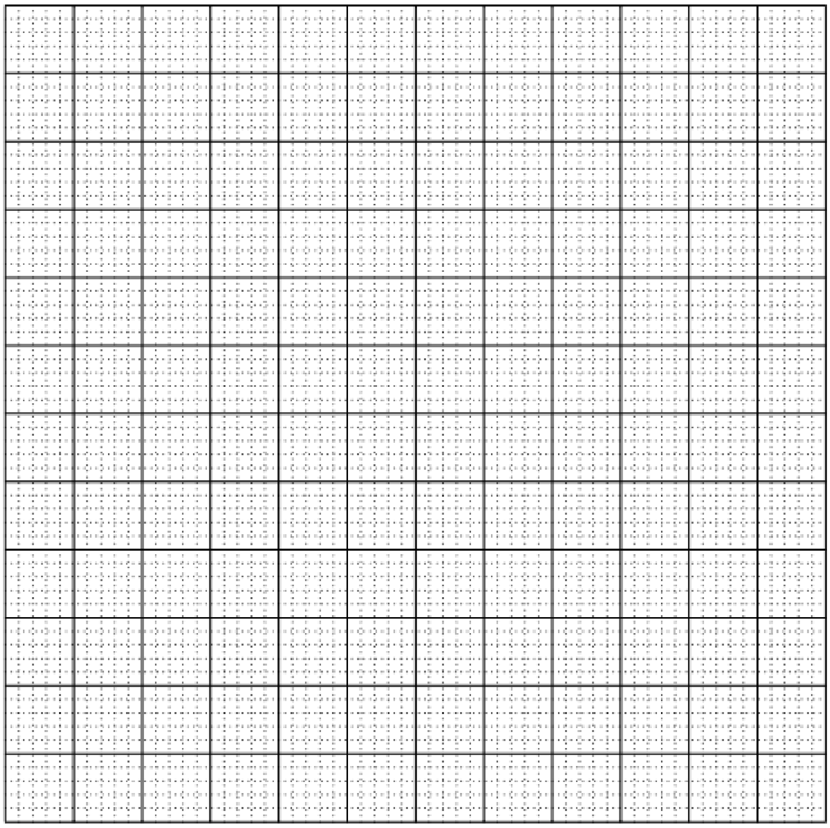
Experimental Procedure

- Set up the circuit in Figure-1, paying attention to the power supply and the ammeter and its terminals. The current value can be changed by turning the amplitude adjustment knob (Voltage)of the power supply clockwise. Set the current values in the table in order and read the corresponding voltage values (V1, V2, V3) to each current value with a voltmeter.
- Write the values read in the table. Calculate the value of V_T from the relation $V_T = V_1 + V_2 + V_3$.
- Using the values in the table, draw $V - I$ graphs for V_1, V_2, V_3 and V_T values on the same graph paper. Find the experimental resistance values (R_{experimental}) from the slope of each line on the plotted graph.

I (mA)	V_1 (V)	V_2 (V)	V_3 (V)	V_T (V)
10				
20				
30				
40				
50				

Figure-1





	R_1 (Ω)	R_2 (Ω)	R_3 (Ω)	R_T (Ω)
Theoretical R (Ω)				
Experimental R (Ω)				

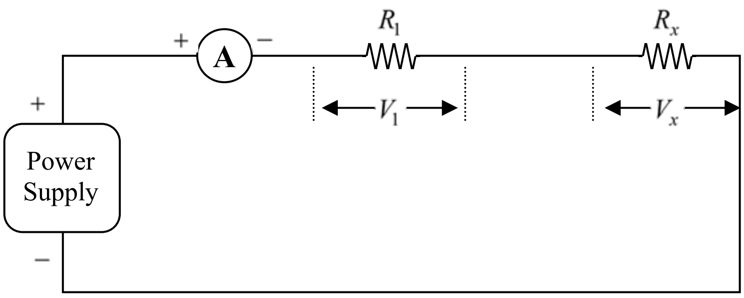
Comment:

EXPERIMENT 2. Measuring an Unknown Resistance with Ammeter and Voltmeter

Experimental Procedure

- Set up the circuit in Figure-2 by paying attention to the (+) and (-) terminals of power supply and ammeter.
- Adjust the current flowing through the circuit to be $I = 30$ mA by turning the amplitude adjustment knob of the power supply clockwise.
- Read the V_x value with a voltmeter, find the R_x value from the $R_x = \frac{V_x}{I}$ relation and write it in the table.

Figure -2



Comment:

I (mA)	V_x (V)	R_x (Ω)
30		

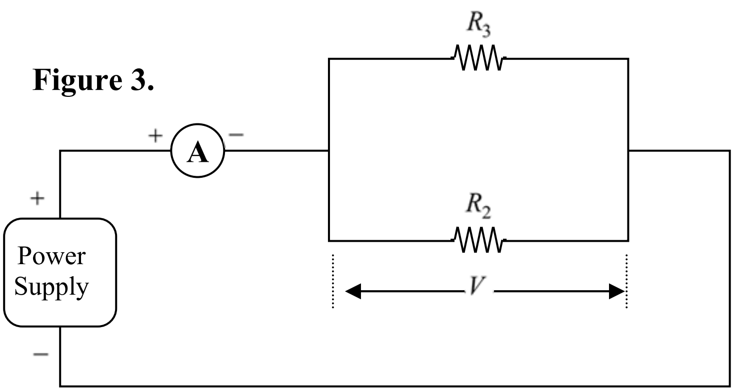
2. RESISTORS IN PARALLEL

EXPERIMENT 1. Experimental Finding of Resistance Values

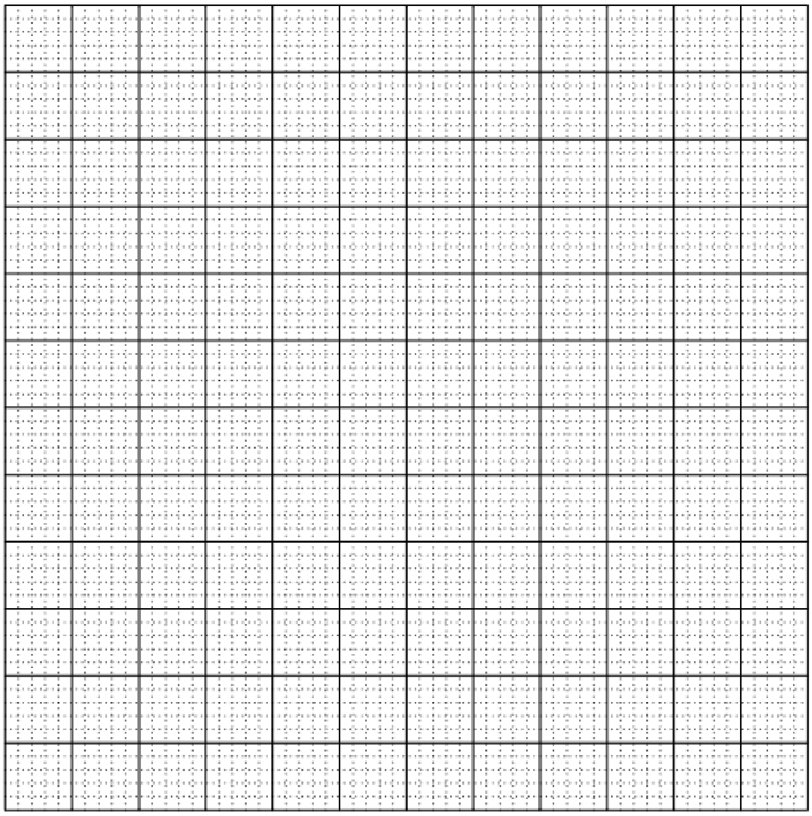
Experimental Procedure

- Set up the circuit in Figure-3, paying attention to the (+) and (-) ends of the power supply and the ammeter.
- Set the current values in the table in order. Read the voltage value corresponding to each current value in turn with a voltmeter.
- Write the values read in the table. Draw the graph using the values in the table. Calculate the resistance value from the slope.
- Find the theoretical resistance value using the equation $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2}$.

Figure 3.



I (mA)	V (V)
20	
40	
60	
80	
100	



Experimental R_{eq} (Ω)	Theoretical $\boldsymbol{R_{eq}}$ (Ω)

Comment:

EXPERIMENT 2. Measurement of Current in Each Branch in a Parallel Resistor Circuit

Experimental Procedure

- Using the amplitude adjustment knob of the power supply, without disturbing the circuit in Figure 3, adjust the current through the circuit to be I=100 mA and turn the power supply off by keeping the current set at this value.
- Convert the circuit in Figure 3 to Figure 4 and Figure 5, respectively. Read the currents passing through the branches, respectively, and write them in the table.
- Find the main branch current experimentally using the equation $I = I_2 + I_3$.

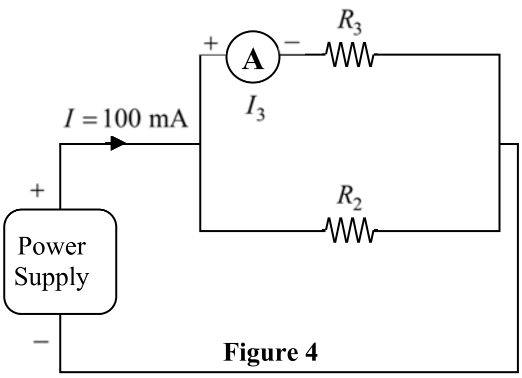


Figure 4

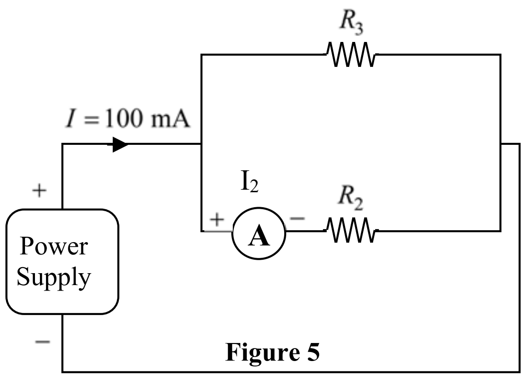


Figure 5

I_3 (mA)	I_2 (mA)	**Experimental** ***I*** **(mA)**

Comment: