THE EQUVELENT RESISTANCAN OF TWO RESISTORS CONTACT IN SERIES AND PARRELLEL

General Physics Laboratory (PHY119)

1 Introduction:

Resistors and batteries are two of the most essential components of any circuit. In this experiment, we will connect resistors in several different ways to observe how resistors in different connections affect the flow of electrons (current) in the circuit.

2 Objective:

1. To calculate the equivalent resistance of two resistors in series.

2. To calculate the equivalent resistance of two resistors in parallel.

3 Theory:

Circuit connection

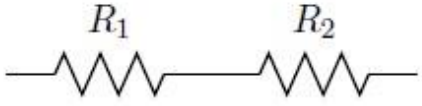
A circuit can be connected in different ways. The most simple and common ways are series and parallel connection.

1. Series circuits:

- All components are connected end-to-end, forming a single path for electrons to flow (all components share the same current). - Total resistance of circuit is the sum of individual resistance.

$$R_{eq} = R_1 + R_2 + \ldots R_n \qquad (1)$$

- Total voltage of circuit is the sum of individual voltages.

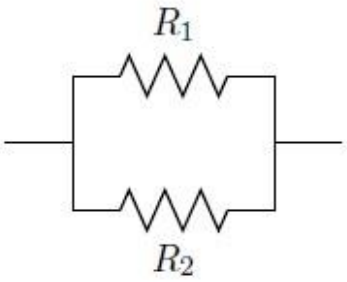


(a) Resistors in series

2. Parallel circuits:

- All components are connected across each other, forming exactly two sets of electrically common points (same voltage across these points).
- Total resistance of circuit is less than any individual resistance.

$$R_{eq} = [\frac{1}{R_1} + \frac{1}{R_2} + \cdots \frac{1}{R_n}]^{-1} \qquad (2)$$



(b) Resistors in parallel

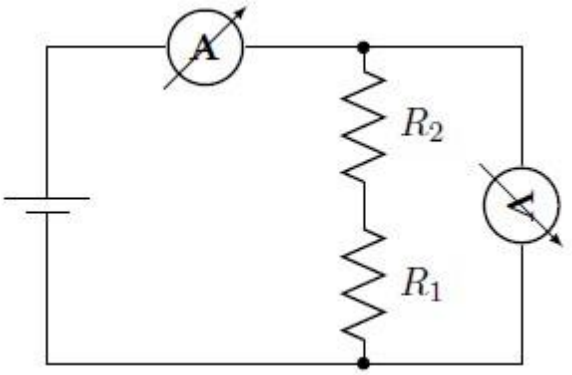
4 Equipment

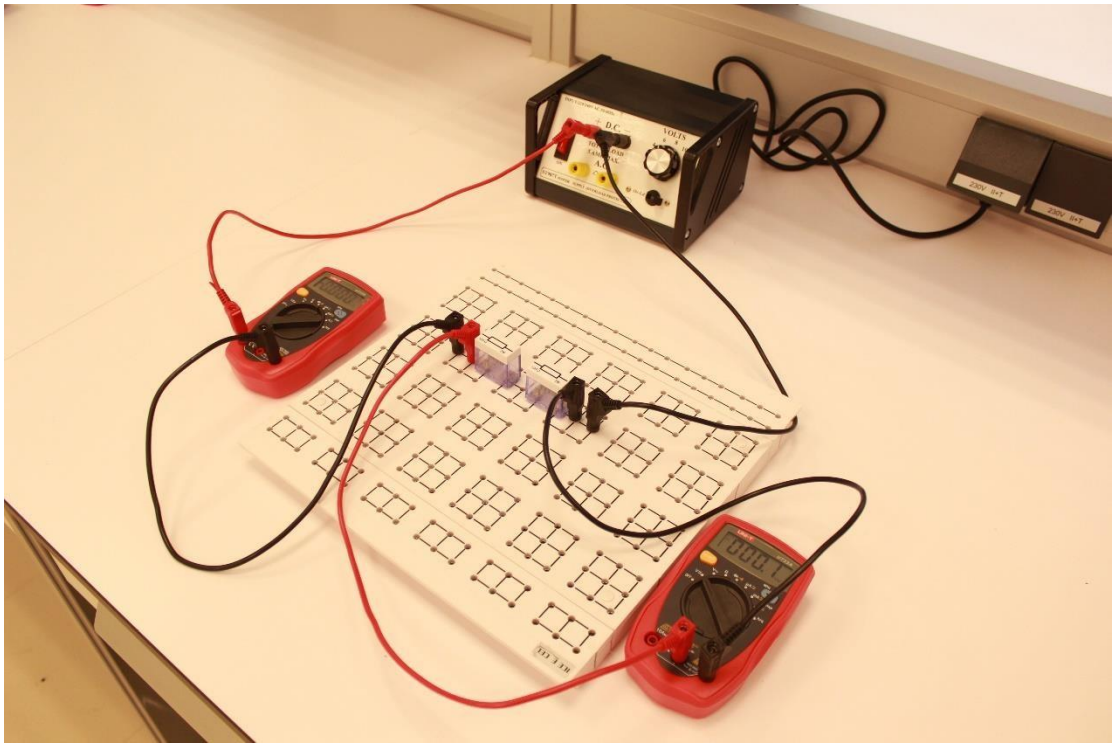
DC power supply – Ammeter – Voltmeter – breadboard - resistors – connecting leads. Instead of using ammeters and voltmeters; digital or analog multimeters could be used.

5 Procedure

Part A:

1. Connect the circuit as illustrated in the figure below.





2. Calculate the maximum total voltage both resistors can withstand.
   Hint: Voltages are added in series.
3. Calculate the real equivalent resistance.
4. Turn the power supply on, and then change the voltage V and read the current I from the ammeter. These measurements should be recorded in the following table,

V (……)	I (…..)

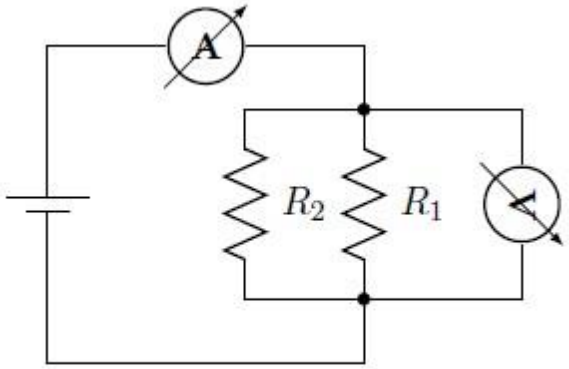
5. Use the data table to plot a graph between the current and the voltage.
6. Draw a best fit line to the points on your graph.
7. Determine the slope from the best fit line.
8. Find a relationship between the slope and the equivalent resistance R

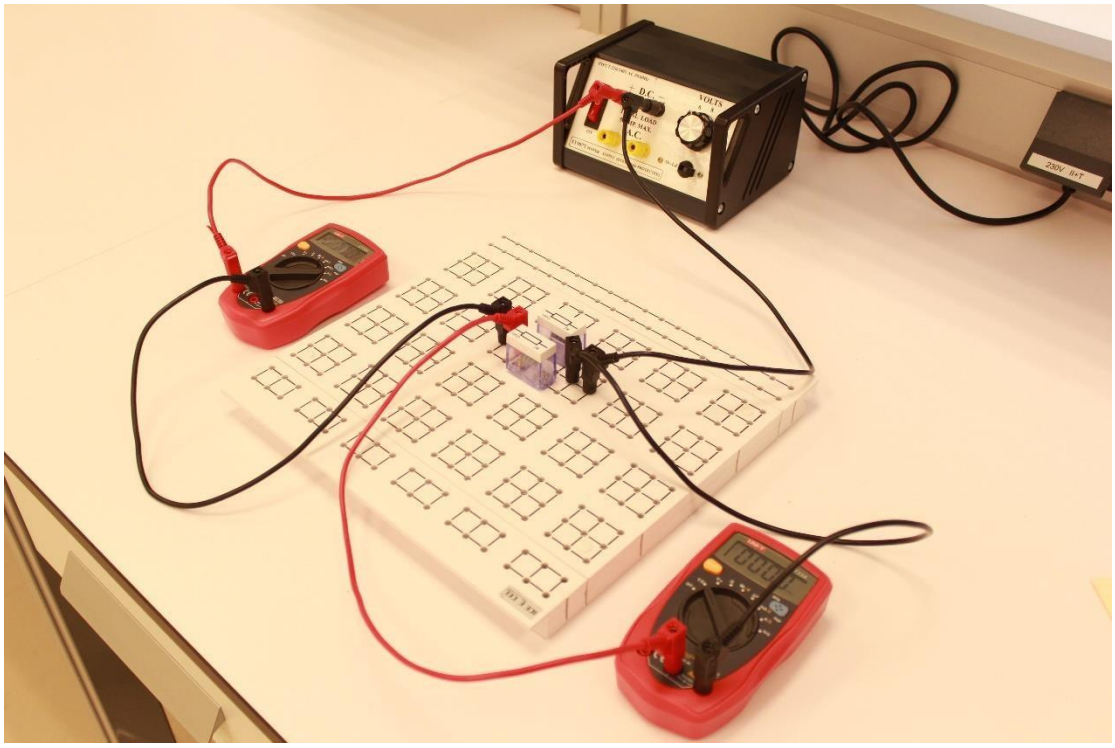
(eq. 1)

9. Determine the value of the equivalent resistance R.

10. Find the percentage error. **Part B:**

1. Connect the circuit as illustrated in the figure below.





2. Calculate the maximum total voltage both resistors can withstand.
Hint: Voltages are the same in a parallel circuit.

3. Calculate the real equivalent resistance.

4. Turn the power supply on, and then change the voltage V and read the current I from the ammeter. These measurements should be recorded in

the following table,

V (……)	I (…..)

5. Repeat steps from 5-10 in part A.

6 Precautions

1. All electrical circuits should be handled carefully!

2. To protect the ammeter (or any voltage or current meter), use the large scale first and then gradually move to a more sensitive scale. Starting with the sensitive scale first may seriously damage the unit.

3. Always monitor the current into the ammeter and do not allow the current to exceed the ammeter's scale!

4. In this lab, use only the power supply's dc voltage outputs, not the ac voltage outputs!

5. The power supply needs to be set to constant voltage mode. You should not use the voltmeter and ammeter displays on the power supply to record the circuit voltages and currents. Instead, use the voltage probe from the analog multimeter .

6. The ammeter should always be connected in series with the circuit elements.

7. The voltmeter should always be connected parallel to the circuit elements.

8. Take your time and carefully plan out how you will solve each Objective.

Conclusion:

Discuss your result