

## **Abstract:**

1. The aim of the experiment is: to test if the material is Ohmic or non-Ohmic material by the plot and then finding the resistance from it.
2. The method used is: Voltmeter – Ammeter method.
3. The main result is :  $R =$

## **Theory:**

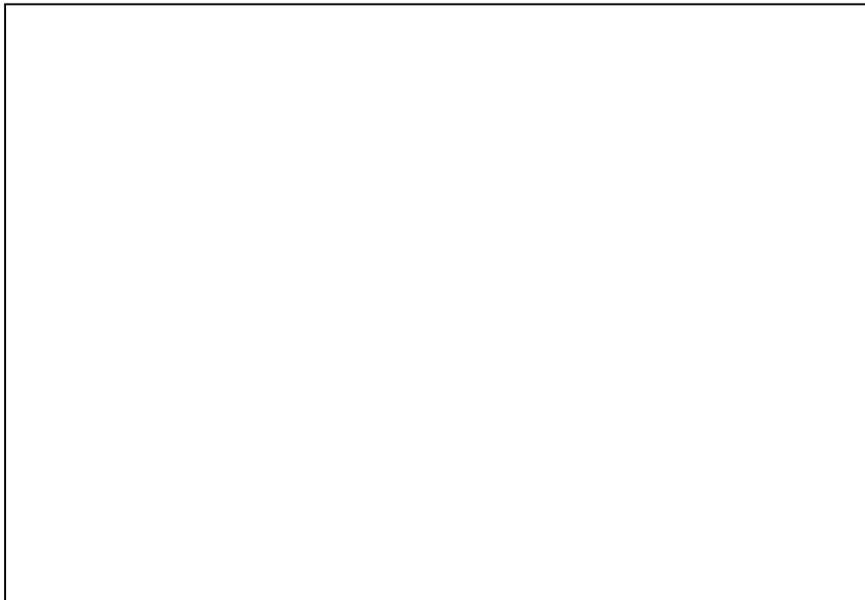
The resistance  $R$  of a metallic conductor is defined by:

$$R = \frac{\text{voltage}}{\text{current}} = \frac{V}{I}$$

where  $I$  is the current flowing through the conductor and  $V$  is the potential difference applied between the endpoints of the conductor.

Materials are divided into two parts according to Ohms' law : Ohmic and Non-Ohmic materials.

For a metallic conductor the resistance is constant provided that the temperature of the wire stays essentially constant because the resistance  $R$  doesn't depend on either  $V$  or  $I$  but on the temperature of the material.



*Figure 1.0*

We can test if the material is Ohmic or not by plotting a graph of the potential difference  $V$  across the material against the current  $I$  through it keeping the temperature of the material constant. If the graph is not a line the material is Non-Ohmic.

If two resistors are connected in parallel then we can substitute our resistor equivalent to both of them of magnitude  $R_p$  where:

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} \Rightarrow R_p = \frac{R_1 R_2}{R_1 + R_2}$$

If two resistors are connected in series then the resistors could be replaced by a single equivalent resistor  $R_s$  :

$$R_s = R_1 + R_2$$

The uncertainty in R ( $\Delta R$ ) is calculated by:

$$\frac{\Delta R}{R} = \frac{\Delta V}{V} + \frac{\Delta I}{I}$$

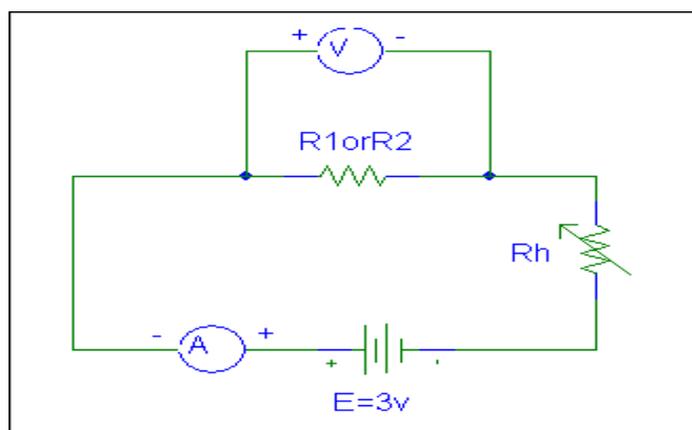
## Procedure:

### A. One Resistance:

We connected the following circuit using only one resistance which was R1. We are provided with a power supply of 3 or 4 volts.

Figure 2.0

A circuit with one resistance.



We estimated the uncertainty in our measurements in the current and voltage from the scale of the voltmeter and the ammeter we used ( $\Delta I, \Delta V$ ). As we used the scale of 3 volts in the voltmeter where every volt is divided into tenths our estimation

of  $\Delta V$  was  $\Delta V = 0.1 \text{ volts}$ , also we used the scale of  $50 \text{ mA}$  in the ammeter so we estimated  $\Delta I = 2.0 \text{ mA}$ .

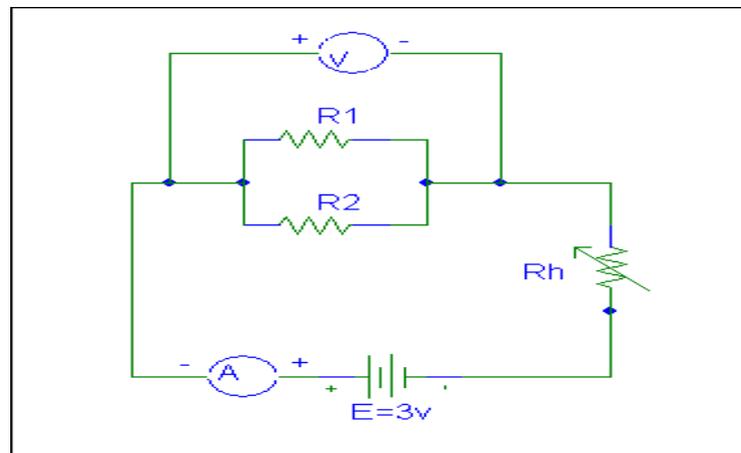
Then we measured the current  $I$  in the resistor and the potential difference  $V$  across the resistance. After that we changed the current by adjusting the variable resistor  $R_h$  and again measured  $I$  and  $V$ . We repeated the changing for 6 times and wrote down our measurements. We tried to take as large range as possible ( a difference of  $0.5 \text{ volt}$  each time ).

### **B. Two Resistors in Parallel:**

We connected the following circuit with the resistors  $R_1$  and  $R_2$  in parallel as in the following circuit.

Figure 3.0

A circuit with two resistances connected in parallel.



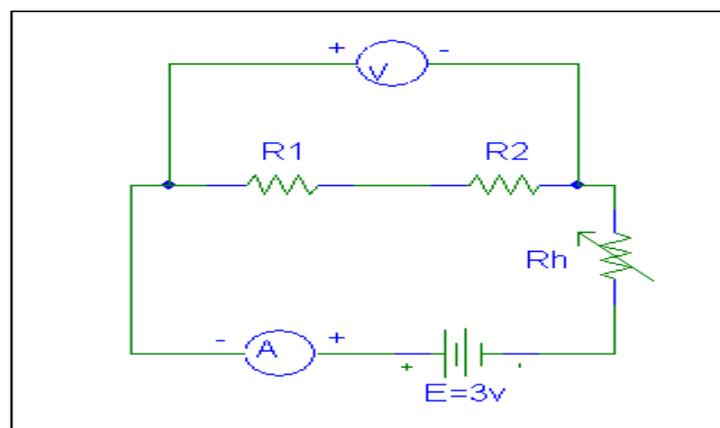
We estimated the error in our readings of  $I$  and  $V$  as we did before because we used the same scales in each of the ammeter and the voltmeter. After that we wrote down the reading ( only one time ).

### **C. Two Resistors in Series:**

We connected the following circuit with resistors  $R_1$  and  $R_2$  in series as the following circuit:

Figure 4.0

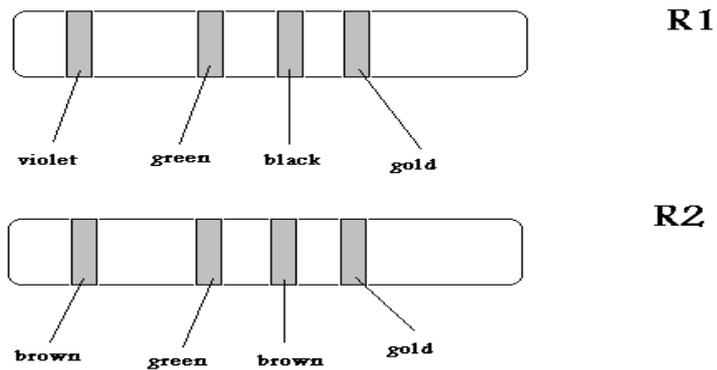
A circuit with two resistors connected in series.



We estimated the error in reading our values as we did before because we used the same scale in each of the voltmeter and the ammeter. We wrote down the readings of the ammeter and the voltmeter ( only one time ).

**D. The Values of the two resistors using the color code:**

The two resistors were as shown in the following sketches:



**Data:**

No.	1	2	3	4	5	6	7	Average
I (mA)	46	38	30	22	14	10	4.0	23
V(volts)	3.0	2.5	2.0	1.5	1.0	0.7	0.3	1.6

## ***Calculations:***

## ***Results and Conclusion:***

$$R_s = R_1 + R_2$$

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The calculation of each resistor includes a part of the other's period of error range. Also the results calculated were corresponding ( with its range of error ) with the values read with the color code. We assume that our calculations were somehow precized.