MARMARA UNIVERSITY
FACULTY OF ENGINEERING

PHYS 1104

PHYSICS LABORATORY II

Ohm's Law and Resistivity of a Conductor

Section:
Group:
Instructure: Date:

	Department	Student Id Number	Name & Surname
1			
2			
3			

1 Purpose

To become familiar with the use of the voltmeter and the ammeter to measure DC voltage and current. In addition, to test the validity of Ohm's law. To determine the resistivity of several materials.

2 Theory

According to Ohm's law, the voltage across a resistor is proportional to the current passing through it:

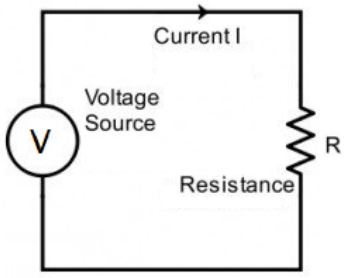

Figure 1: Simple Circuit

$$V = IR \tag{1}$$

where the ratio of the voltage (V) over the current (I) is called the resistance (R). The unit of resistance is ohm, which is equal to one volt per ampere.

Most physical quantities of a material can be characterized as being either intrinsic or extrinsic properties. An intrinsic property is a property of a material that does not depend on the amount of material present. An extrinsic property, on the other hand, does depend upon the amount of material present. For example, all blocks of copper have the same density, since they are made of the same material, but different blocks can have different masses. Density is thus an intrinsic property. Mass, however, is an extrinsic property. A similar relationship exists between resistance and resistivity for an object when an electric current is passed through it. The resistivity, like the density, depends on the type of material. Every block of copper has the same resistivity. The resistance, like the mass, depends on how much of the material is present. The relationship between the resistance and the resistivity can be summed up by the following formula: In SI unit system, ohm (Ω) symbol is used for defining the resistance.

$$R = \frac{\rho l}{A} \tag{2}$$

3 Experimental Setup

3.1 Equipment List

1. Board x1
2. Copper Wires x2
3. Aluminum Cromel wire x1
4. Dc voltage source x1
5. Digital multimeter x2
6. Connection cables 40cm x2
7. Banana Plug to Crocodile Alligator Clip x4
8. Rheostat x1

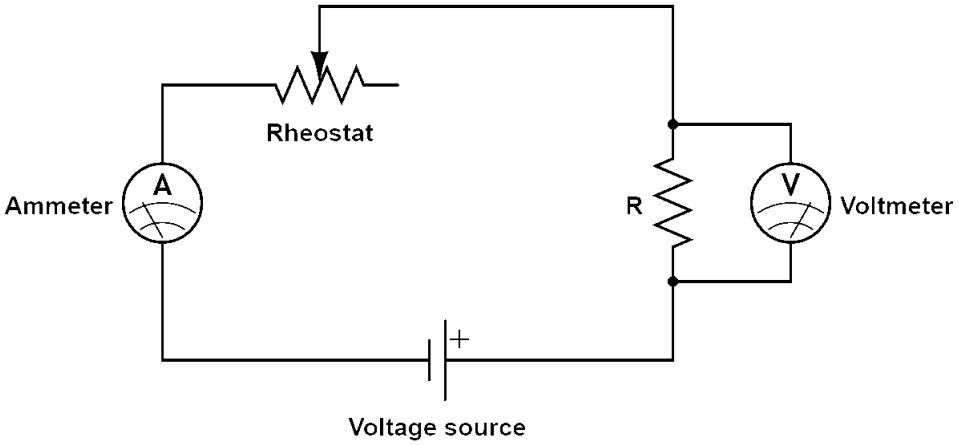

Figure 2: Circuit diagram

4 Procedure

1. Measure and record the length of each wire with ruler.
2. Measure and record the diameter of each wire with micrometer for cross-sectional area.
3. Connect the ammeter and rheostat (a variable resistor) in series to the terminals of the voltage source (5 volts).
4. Connect the voltmeter to the terminals of the wire in parallel.
5. Obtain different current values by changing the position of the slider on rheostat.
6. Read the potential differences across the wire from the voltmeter for each current value and record them.

7. Calculate the resistance and resistivity for each measurement using equations 1 and 2.
8. Plot voltage versus current graph for each table.
9. According to equation 1, the slope of this graph gives average resistance value.
10. Repeat these steps for different type and diameter of wires given to you.

	Type of Wire	Diameter (m)	Length (m)			Type of Wire	Diameter (m)	Length (m)	
	V(v)	I(A)	$R(\Omega)$	$\rho(\Omega.m)$		V(v)	I(A)	$R(\Omega)$	$\rho(\Omega.m)$
1									
2									
3									
4									
5									

	Type of Wire	Diameter (m)	Length (m)			Type of Wire	Diameter (m)	Length (m)	
	V(v)	I(A)	$R(\Omega)$	$\rho(\Omega.m)$		V(v)	I(A)	$R(\Omega)$	$\rho(\Omega.m)$
1									
2									
3									
4									
5									

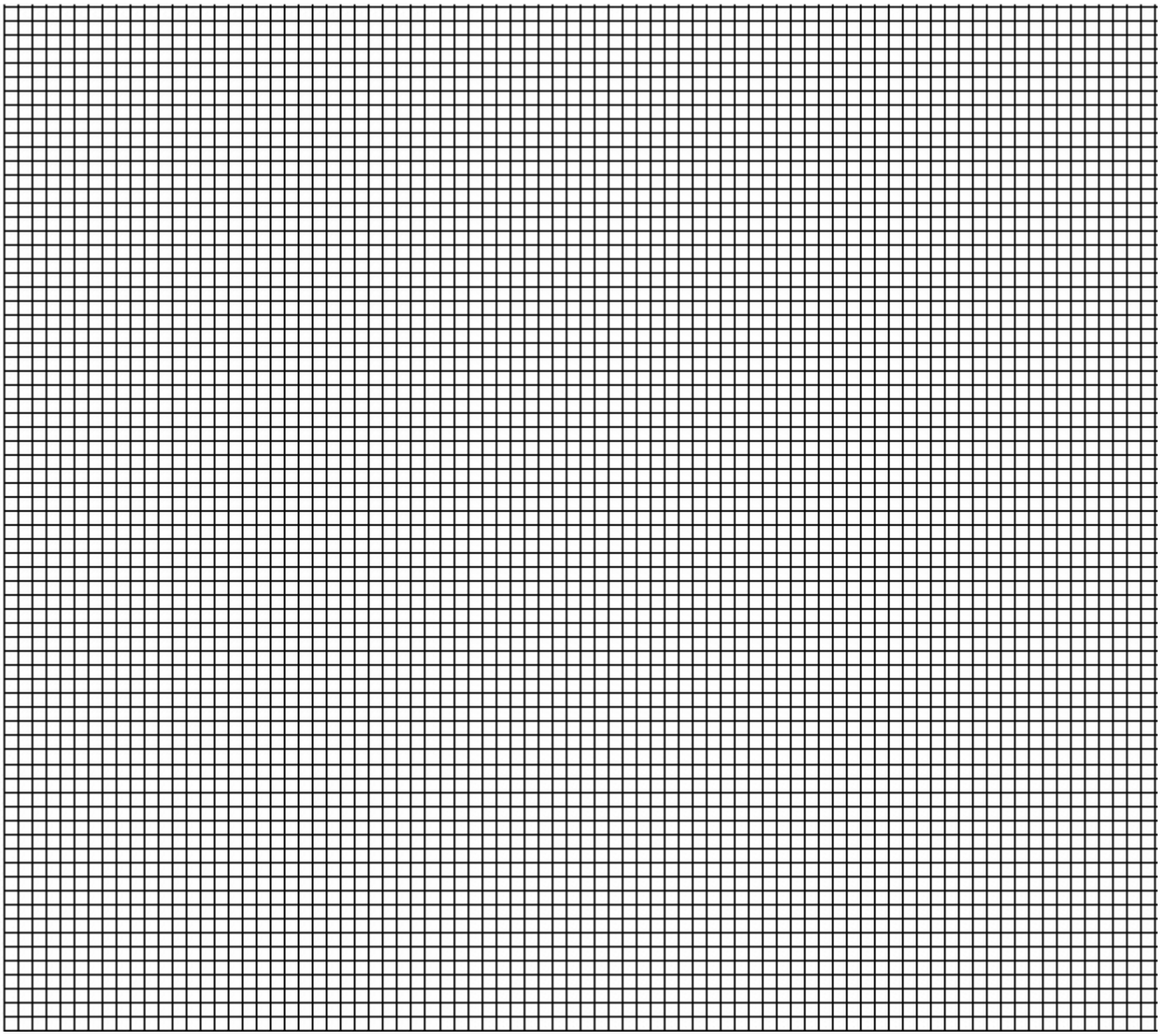

Figure 3: Voltage versus current graph. (Unit is 2 mm)

Slope (average resistance) = ... Ω

Experimental Resistivity = ... $\Omega.m$

Theoretical,Resistivity = ... $\Omega.m$

% error of resistivity = ...