Number:
Name Surname: *Experiment 1*
Department:

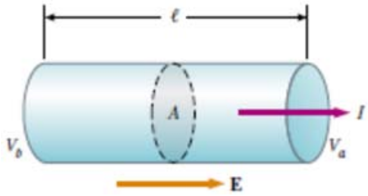
1. RESISTIVITY DETERMINATION

Theoretical Background

If a potential difference is applied between the ends of a conductor, a current density and electric field are created inside the conductor. If the potential difference is constant, the current in the conductor is also constant. In some materials, the current density is directly proportional to the electric field. The relation

$$\mathbf{J} = \sigma \mathbf{E}$$

is given. σ is the conductivity coefficient. Substances that satisfy this equality are called as substances that obey Ohm's law.



A more useful form of Ohm's law in practical applications is obtained by examining a linear piece of wire with cross section A and length l. A potential difference $\Delta V = V_b - V_a$ is applied to the ends of the wire, which creates an electric field and current in the wire. Assuming that the electric field in the wire is uniform, then the relation

$$\Delta V = E\ell$$

can be written. So the magnitude of the current density is expressed as,

$$J = \sigma E = \sigma \frac{\Delta V}{\ell}$$

Since $J = I / A$, the potential difference can be written as

$$\Delta V = \frac{\ell}{\sigma} J = \left(\frac{\ell}{\sigma A} \right) I$$

The opposite of conductivity is called resistivity and is denoted by ρ. Accordingly, the last expression;

$$\Delta V = \left(\rho \frac{\ell}{A} \right) I$$

is found. In the equation $\rho \frac{\ell}{A}$ is the resistance of the conductor and it is written as

$$R = \rho \frac{\ell}{A}$$

EXPERIMENT. Determination of Resistivity

Experimental Procedure

- The voltmeter is set to 20 V and the ammeter to 200 mA, and these settings are absolutely unaltered.
- The circuit shown below is set up. Attention should be paid to the power supply and the ammeter and its (+) and (-) leads.
- By turning the amplitude adjustment knob of the power supply clockwise, the voltage values for the thick wire are adjusted, respectively, as seen in table 1. The current values corresponding to these values are read from the ammeter and written in the relevant place in Table 1.
- By turning the amplitude adjustment knob of the power supply clockwise, the voltage values for the fine wire are adjusted, respectively, as seen in Table 2. The current values corresponding to these values are read from the ammeter and written in the relevant place in Table 2.
- Using the values in the table, the V-I graphs for the thick wire and the thin wire are plotted on the same graph paper. Their resistances are calculated from their slopes and written in the relevant place in Table 3. Resistivity for each wire is found by using the equation $R = \rho \frac{\ell}{A}$ and written in Table 3.

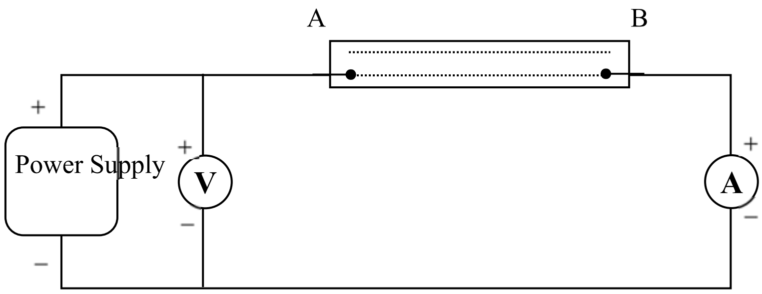


Table 1: For thick wire						
V (V)	0	1	2	3	4	**5**
***I* (mA)**						

Table2: For fine wire								
V (V)	0	2	4	6	8	10	12	**14**
***I* (mA)**								

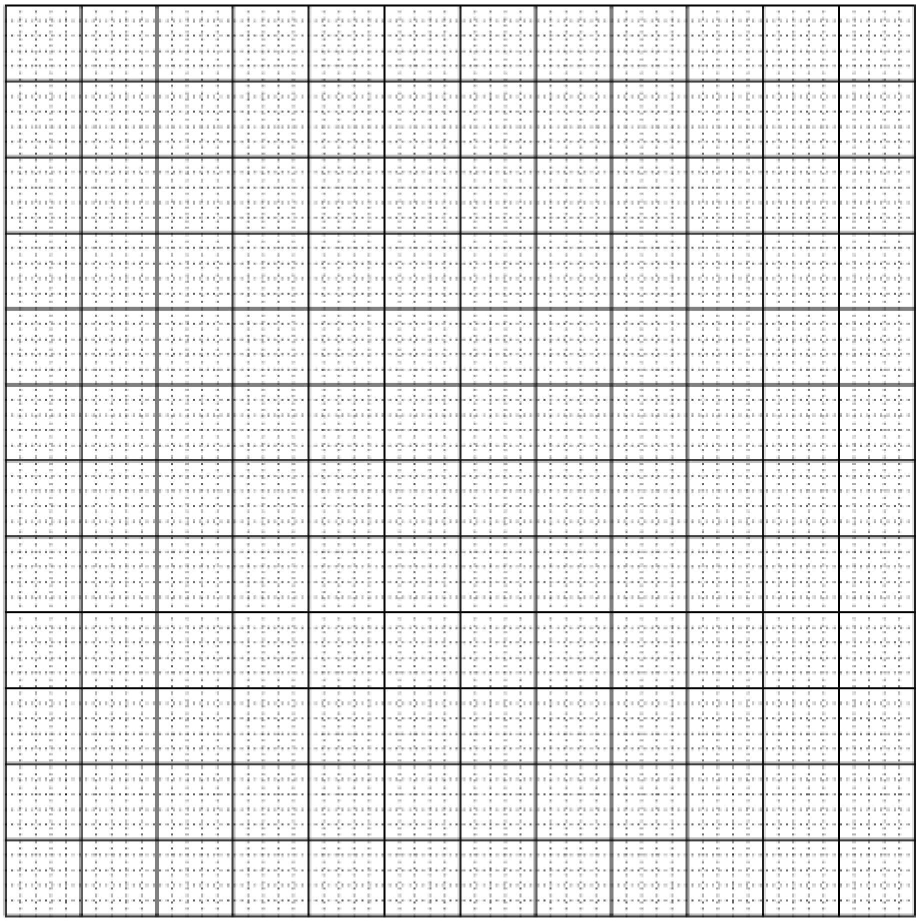


Table 3			
Thick wire		**Fine wire**	
R (Ω)	*ρ* (Ω.m)	*R* (Ω)	*ρ* (Ω.m)

Comment: