

## Experiment 5

### Experiment 5-B : Effect of Temperature on Resistivity of Metals

#### **Objectives:**

To study the effect of temperature on the resistivity of copper.

#### **Apparatus:**

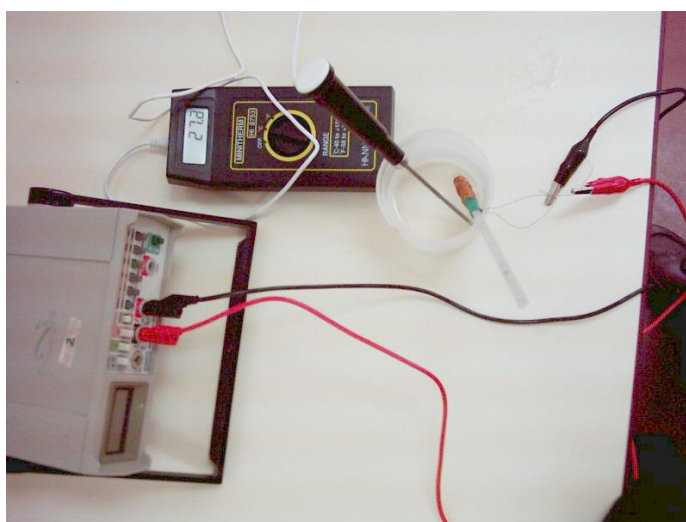


Figure5B- 1 Experimental set up used in the experiment

1. DC power supply.
2. Digital multimeters (or an ohmmeter).
3. Caliper or micrometer (recommended).
4. Glass cups.
5. Water, ice, and water heater.
6. Thermometer.
7. A copper wire, 5 m long.
8. Crocodile clip ended connecting leads.

#### **Theory:**

Although resistivity is a material property and is independent on geometry, it is influenced by other factors. These include temperature, impurities concentration, and plastic deformation. In this experiment, the resistivity of a metal wire will be measured at three different temperatures to study the effect of temperature on the resistivity.

More details about factors affecting the resistivity of metals are covered in your text book in the following sections: 19.8

**Procedure**

1. Use the 5 m long copper wire provided to you on a plastic rod, and a multimeter or an ohmmeter to assemble the circuit in Fig 5B-2.

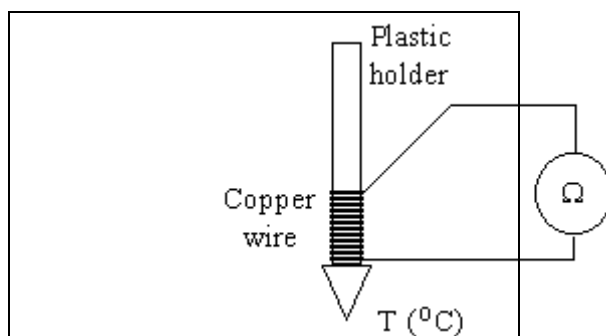


Fig5B-2: Illustration of the resistance-temperature measurement setup

2. Measure the diameter of the copper wire and record your measurements in Table 5B-1.
3. Measure the wire resistance and record the reading in Table 2.
4. Use a thermometer to measure the room temperature and record your measurement in Table 5B-1.
5. Heat a glass of water till water boils. Measure water temperature and record you reading in Table 5B-1. Keep the water boiling.
6. Immerse the copper wire in the boiling water and read the wire resistance. Wait till the ohmmeter reading settles, then and record measured value in Table 5B-1.
7. Repeat procedures 5 and 6 using ice.
8. Using the copper wire dimensions and the measured resistance values in Table 5B-1, calculate the resistivity of the wire for each case above.

**Table 5B-1:** Resistivity vs. Temperature for copper wire (L =...m, D =...m).

Environment	Measured temperature (°C)	Temperature (K)	Measured resistance (Ω)	Calculated resistivity r (Ω.m)
Room temperature				
Boiling water				
Iced water				

### **Data Analysis**

Plot the resulting resistivity values versus temperature in Kelvin.

From the obtained curve, express the resistivity as a function of temperature.

### **Discussion and conclusions**

Write a concise account of the experiment and the results obtained.