# OHM'S LAW
## Experiment 10

### INTRODUCTION:

The study of electricity is the study of charges and their motion. When electric charges move in a material, *electric current* is formed. The rate of this motion is measured in *amperes*. Charges flow due to a difference in *electric potential or voltage* between the two ends of a conductor. This is analogous to water flowing through a pipe due to the difference in pressure between the two ends of a pipe. When charges flow through any material, they experience a resisting force due to molecular collisions between the charges and particles of matter. This force is called *electrical resistance* and is measured in *ohms*.

The relationship among voltage, resistance and current is summarized in a statement called *Ohm's law*. Ohm discovered that the amount of current in a circuit is directly proportional to the voltage established across the circuit and inversely proportional to the resistance of the circuit. In mathematical form this relationship can be expressed as:

$$\text{current} = \frac{\text{voltage}}{\text{resistance}}$$

$$\text{or} \quad I = \frac{V}{R}$$

where        $V$ = potenial difference, in volts,

$I$ = current, in amperes,

$R$ = resistance, in ohms.

In this experiment you will determine the resistance of a known and an  unknown resistor through voltage and current measurements.

### APPARATUS & MATERIAL:

- ?   44-ohm rheostat
- ?   dc voltmeter
- ?   dc milliammeter
- ?   40-ohm resistor
- ?   unknown resistor
- ?   connecting wire

### PROCEDURE:

**Part A**
1. Connect a 40-ohm resistor and the electrical components in a series circuit, as shown in Fig. 1. The voltmeter is connected across (in parallel with) the 40-ohm resistor.
2. Have the instructor check the circuit when you have everything connected. He or she will connect the circuit to a low-voltage power supply and make sure the circuit is connected properly before you proceed.
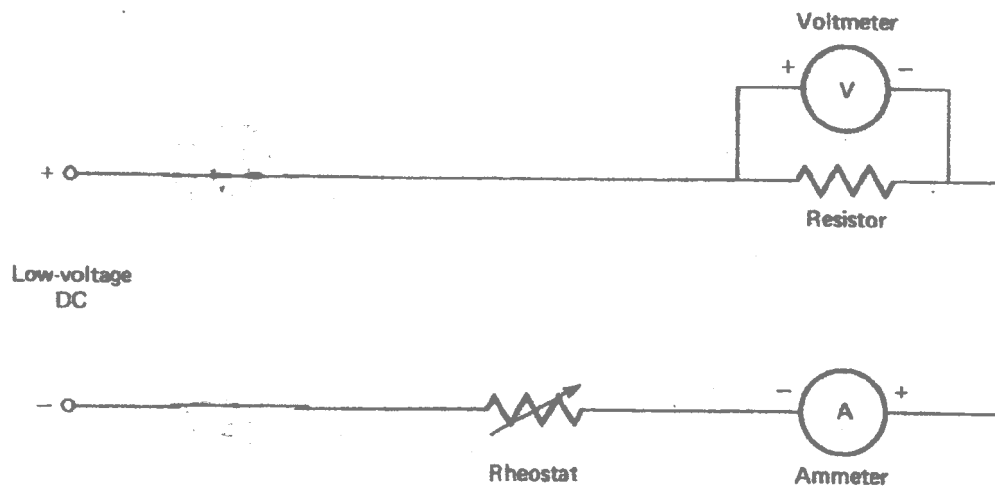


**Figure    1**

3. Adjust the rheostat at different settings and obtain at least six different values for the current and voltage. Begin by setting the rheostat at the position that measures the smalles current in the circuit. Afterwards move the rheostat at approximately equal intervals and records each measurement in Table 1.

**Part B**

4. Disconnect the circuit from the power supply. Remove the 40-ohm resistor and replace with an unknown resistor. Have the instructor check the circuit again before proceeding.
5. After the instructor reconnects the circuit to the power supply, repeat step 3 above with the unknown resistor. Record data in Table 2.

Physical Science 14

Name:_____

# **REPORT FORM**
## Experiment 10

**TABLE 1**
**40-Ohm Resistor**

| Rheostat Setting | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Voltage, in volts | | | | | | |
| Current, in amp. | | | | | | |

**TABLE 2**
**Unknown Resistor #_____**

| Rheostat Setting | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Voltage, in volts | | | | | | |
| Current, in amp. | | | | | | |

## **CALCULATIONS:**

1. Graph data in Table 1 as current (x-axis) vs. voltage (y-axis), and determine the slope of the resulting line. Shown calculations below.

Slope=_____

2. Graph data in Table 2 as current (x-axis) vs. voltage (y-axis), and determine the slope of the resulting line. Shown calculations below.

Slope=_____

**QUESTIONS:**

Investigate the properties of each circuit provided in the lab, and answer the following questions:

1. What change do you observe in the brightness of the lamps in a series circuit as more lamps are added to the circuit?  Give an explanation for your observation.



2. What change do you observe in the brightness of the lamps in a parallel circuit as more lamps are added to the circuit?  Give an explanation for your observation.



3. What happens in a series circuit as one of the lamps is disconnected?



4. What happens in a parallel circuit as one of the lamps is disconnected?



5. A voltmeter reads 80 volts when connected in parallel with an unknown resistor that has 0.125 amperes flowing through it.  What is the resistance of the unknown resistor?  Show all your calculations below.