Laboratory Application Assignment

In this lab application assignment you will examine the difference between a linear and nonlinear resistance. Recall from your reading that a linear resistance has a constant value of ohms. Conversely, a nonlinear resistance has an ohmic value that varies with different amounts of voltage and current.

Equipment: Obtain the following items from your instructor.

- Variable DC power supply
- DMM
- 330-Ω and 1kΩ carbon-film resistors (½-W)
- 12-V incandescent bulb

Linear Resistance

Measure and record the value of the 330-Ω carbon-film resistor. R = _____

Connect the circuit in Fig. 3–18. Measure and record the current, I, with the voltage, V, set to 3 V. I = _____

Increase the voltage to 6 V and remeasure the current, I. I = _____

Increase the voltage one more time to 12 V, and remeasure the current, I. I = _____

For each value of voltage and current, calculate the resistance value as $R = V/I$. When V = 3 V, R = _____. When V = 6 V, R = _____. When V = 12 V, R = _____. Does R remain the same even though V and I are changing? _____

Nonlinear Resistance

Measure and record the cold resistance of the 12-V incandescent bulb. R = _____

In Fig. 3–18 replace the 330-Ω carbon-film resistor with the 12-V incandescent bulb.

Measure and record the current, I, with the voltage, V, set to 3 V. I = _____

Increase the voltage to 6 V, and remeasure the current, I. I = _____

Increase the voltage one more time to 12 V, and remeasure the current, I. I = _____

Calculate the resistance of the bulb as $R = V/I$ for each value of applied voltage. When V = 3 V, R = _____. When V = 6 V, R = _____. When V = 12 V, R = _____.

Does R remain constant as the values of voltage and current increase? _____

Does the bulb's resistance increase or decrease as V and I increase? _____

Calculating Power

(330-Ω resistor)

Calculate the power dissipated by the 330-Ω resistor with V = 3 V. P = _____ W

Calculate the power dissipated by the 330-Ω resistor with V = 6 V. P = _____ W

Calculate the power dissipated by the 330-Ω resistor with V = 12 V. P = _____ W

What happens to the power dissipation each time the voltage, V, is doubled?

_____

(12-V incandescent bulb)

Calculate the power dissipated by the 12-V incandescent bulb with V = 3 V. P = _____ W

Calculate the power dissipated by the 12-V incandescent bulb with V = 6 V. P = _____ W

Calculate the power dissipated by the 12-V incandescent bulb with V = 12 V. P = _____ W

What happens to the power dissipation each time the voltage, V, is doubled?

_____

How do the changes in power dissipation when V is doubled compare to the results obtained with the 330-Ω resistor? _____

_____

Volt-Ampere Characteristic of *R*

In Fig. 3-18, replace the 12-V incandescent bulb with a 1 kΩ resistor. Measure the current, I as the voltage, V is increased in 1 V increments from 0 to 12 V. Create a table to record your answers. From the data recorded in your table, draw a graph of the V and I values. This graph represents the volt-ampere characteristic of the 1 kΩ R.

Reconnect the 12-V incandescent bulb in Fig. 3-18. Measure the current, I as the voltage, V is increased in 1 V increments from 0 to 12 V. Create a second table to record your answers. From the data recorded in your table, draw a graph of the V and I values. This graph represents the volt-ampere characteristic of the 12-V incandescent bulb.

How does the volt-ampere characteristic of the 1 kΩ resistor compare to that of the 12-V incandescent bulb? _____

_____

_____

Does the 12-V incandescent bulb have a linear or nonlinear resistance? _____

Explain your answer. _____

_____

Figure 3–18