Lab 1: Nonlinear behavior of Resistors

Objective:
The object of this lab is to understand that heating changes the resistivity of materials. For this we compare the I-V characteristics of a resistor. By measuring the voltage drop across resistor as the current is varied, we study both the linear and non-linear relationship between the current and the voltage.

Resistor Basics:
When a voltage is applied across a resistor, an electric field is established. This electric field "pushes" the charge carriers through the resistor. This "push" gives the charge carriers a "drift velocity" in the direction from high potential energy to low potential energy. As the voltage increases, the drift velocity increases. Since the amount of current flowing through a resistor is directly proportional to the drift velocity, the current is directly proportional to the voltage, which produces the electric field, which produces the drift velocity. Resistors are often used in series with another circuit component to reduce the voltage across that component or in parallel to reduce the current through a component.

General Safety Guidelines:
Always reset the power supply dial to zero, before building or changing the circuit.
Keep your hands and the work area dry to avoid shock.
Follow safe and correct procedures for operating the power supply.

Lab Equipment:
Power supply, multimeter, breadboard, resistor, banana plugs, alligator clips

Procedure:
1. Place resistor in breadboard and measure resistance. Connect one end of resistor to multimeter port marked "**HI**" and the other end of the resistor to the multimeter port marked "**I**" using banana plugs and alligator clips. Resistor should measure approximately 820 ohms.

2. Measure I-V characteristics across the resistor. Use the 0-20 volt leads on the power supply and set the current limiting knob to maximum position. Connect the negative (black) lead of the power supply to multimeter port marked "**LO**". Connect the positive (red) lead of the power supply to the same end of the resistor that is connected to the multimeter port marked "**HI**".

3. Now turn on the power supply and increase the voltage in increments of 0.5V until you reach 20V. Record the current at each increment. Give the multimeter a chance to stabilize at each point.

4. Turn voltage knob down to 0V. Turn off power supply and multimeter. Disassemble lab setup and return equipment to proper place.

Data and Analysis:
Use your data to make a chart similar to the following.

Voltage (V)	Current(mA)	V*I(mW)	dV/dI(mohms)
0.5			xxxxxx

20			

After obtaining these results, you will need to plot two graphs:
I vs V
dV/dI vs V*I

Questions:
1. What was the change in the resistance from your initial to final reading?

2. If a 1 K-ohm resistor is rated for 1 watt at what voltage would you expect its behavior to become nonlinear?

3. Draw the circuit diagram of the setup used to collect the data.