DE ANZA COLEGE – PHYSICS 4B LAB – FALL 2024

Lab 3 – Resistance of a Type 47 Lamp

TITLE

Resistance of Type 47 Lamp

OBJECTIVE

1. To measure the resistance of a Type 47 Lamp using a voltmeter and ammeter
2. Determine whether the lamp is an Ohmic resistor or non-Ohmic resistor by varying the amount of current flowing through the lamp
3. Find a formula for the resistance in terms of the current passing through the lamp
4. Find the **cold resistance** of the Lamp by studying the current-voltage characteristic in the 0-2V region.

THEORY

1. For an Ohmic resistor with a voltage differential of ΔV across, the amount of current that flows through the resistor is I and the ratio is constant.

   $$\frac{\Delta V}{I} = R = \text{const}$$

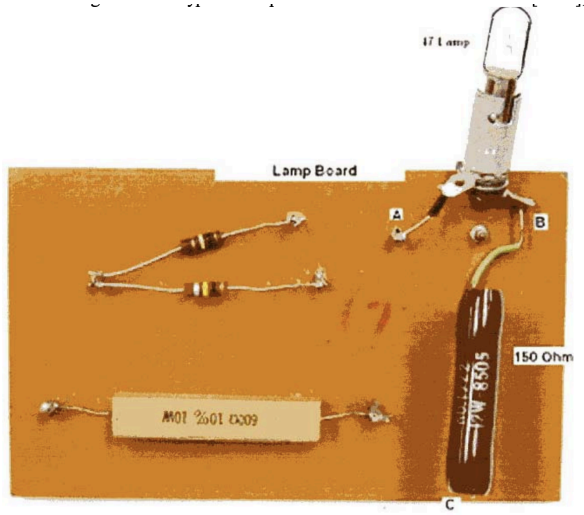
2. For a non-Ohmic resistor, the resistance is a function of the current flowing through the resistor such that

   $$\frac{\Delta V}{I} = R \neq \text{const}$$

   Meaning that the resistance is a function of current across the resistor

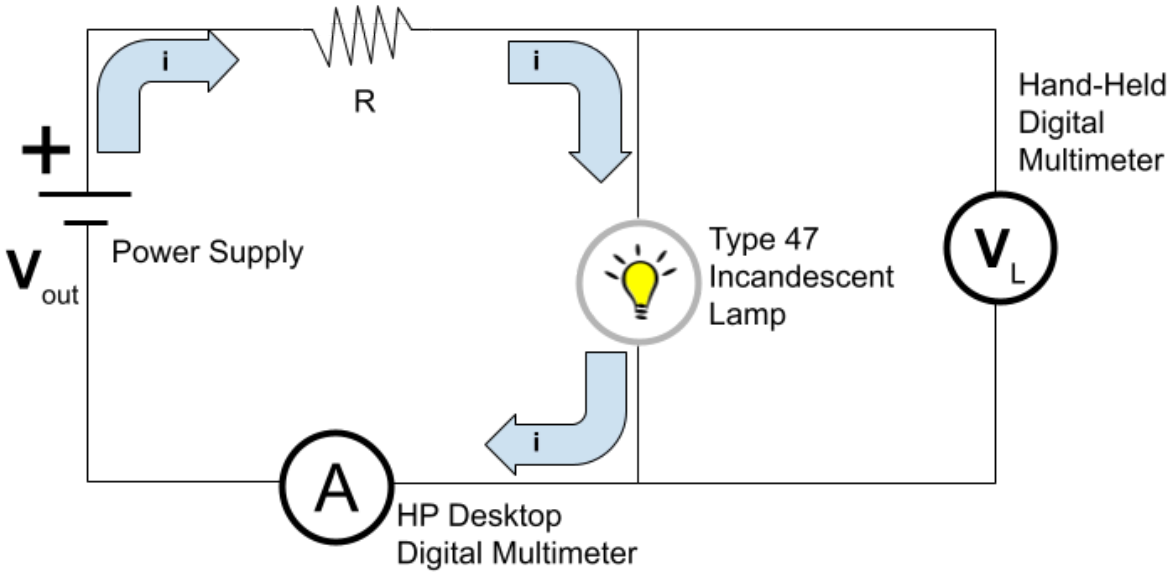
APPARATUS

1. Handheld Digital MultiMeter
2. Desktop Multimeter HP-DMM
3. 150Ω resistor (or Similar)
4. Type 47 Lamp
5. Leads and alligator clips
6. Power Supply



PROCEDURE

1. Set up the following circuit



2. Measure the **cold resistance** of the lamp using the handheld digital multimeter before connecting the power supply
3. Adjust ΔV_{out} to collect data for ΔV_L and I
    a. 10 data points for ΔV_L (0V to 2V) (you will set the ΔV_{out} to higher values to read these values for ΔV_L)
    b. 10 data points for ΔV_L (2V to 6V)
4. Enter the values in Excel or Sheets
    a. Prepare three columns for ΔV_{out}, ΔV_L, and I
    b. Make a chart using ΔV_L in the x-axis and I in the y-axis
    c. Make sure that you indicate the column headers with the units of measurement
5. What is the slope of this curve, R or 1/R?
6. Determine whether the lamp's resistance is Ohmic, if so, calculate R.
7. If the lamp resistance is non-Ohmic then use Excel/Sheets to create a best-fit equation for the data by comparing R^2 of the curve fits between a linear curve fit and your chosen curve fit. Which curve fit has lower R^2?
8. Prepare another table with values of 0.4V, 1.0 V, 1.5V, 2.3V, 3.5V, 4.2V, 5.6V for voltage and use the formula from the curve fit to calculate corresponding resistance values.
9. Using data from **only** 0-2V range, make an analysis of the voltage characteristics and fit a linear curve through the data. How does this compare to the measured **cold resistance**?