

Birzeit University

Physics 112

Experiment #1

Linear and non-linear Circuit Components

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Section: 6

9\11\2022

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Abstract:

- **The aim:** to check whether the (Carbon resistor, Si diode, Light bulb) are linear or non-linear conductors.
- **The method:** is direct measurements of Voltage and electrical current through those components, then doing the proper calculations
- **The main result:**
The resistor is a linear component, whereas the diode and the light bulb aren't.

Introduction:

The Ohm's law that the current through a conductor between two points is directly proportional to the voltage.

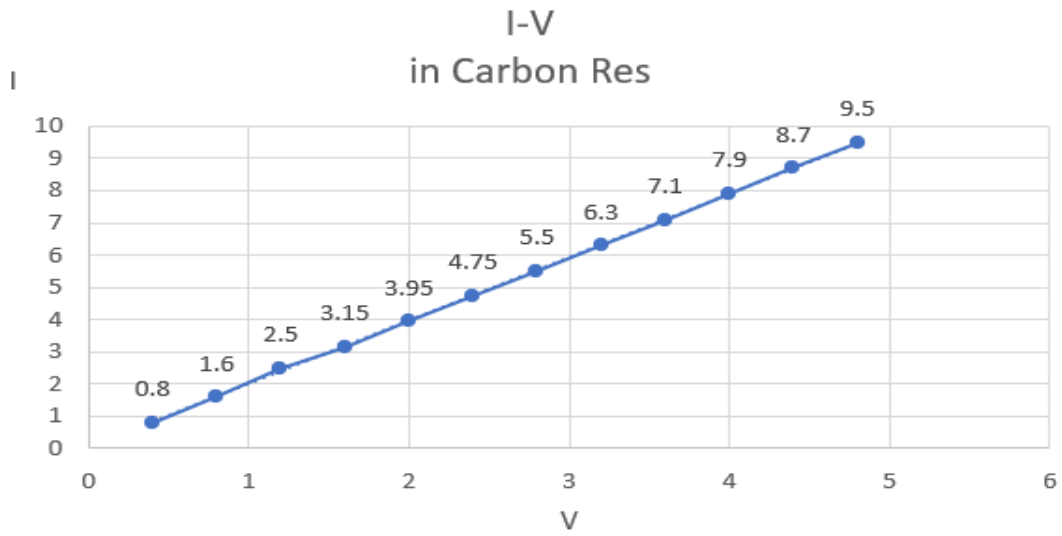
$$V = IR$$

where I is the current through the conductor, V is the voltage measured across the conductor and R is the resistance of the conductor. The relation between the current passing through a circuit and the voltage difference its terminals is called the I-V characteristic of the component. The graph of I vs. V of a linear component is a straight line. ($R = 1/\text{slope}$), And since linear components' graphs are straight lines, then this value is a constant and so is the value of the resistance.

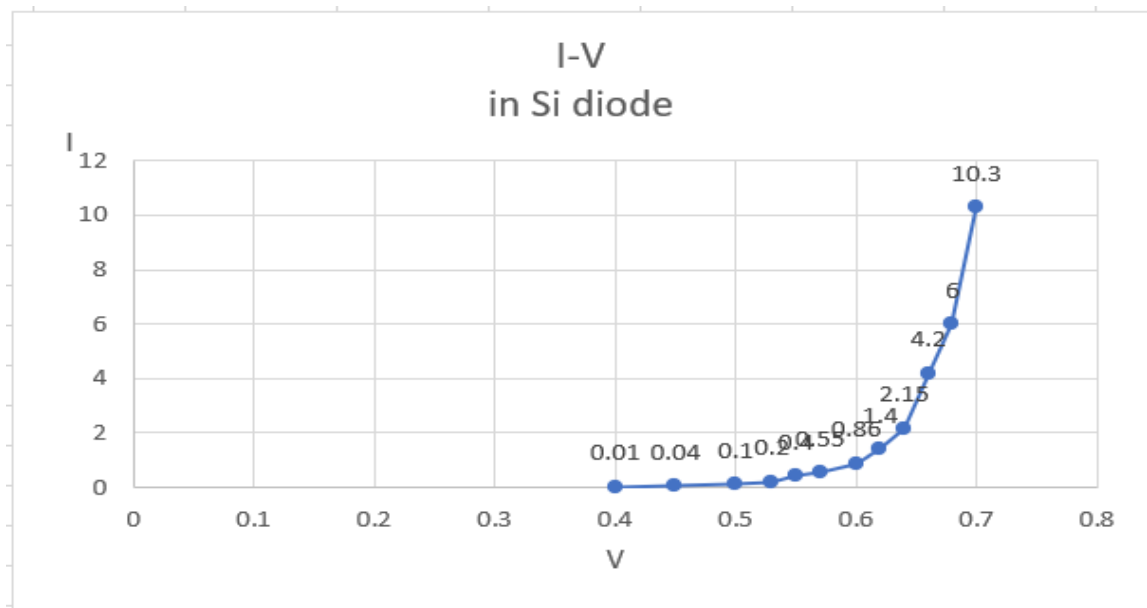
On the other hand, components that don't possess straight line I-V characteristics are called non-linear components. An example is a diode; a device frequently used in electronic circuits to provide on way current paths.

Another example of non-linear component is a light bulb; the resistor of such component depends on the temperature according to:

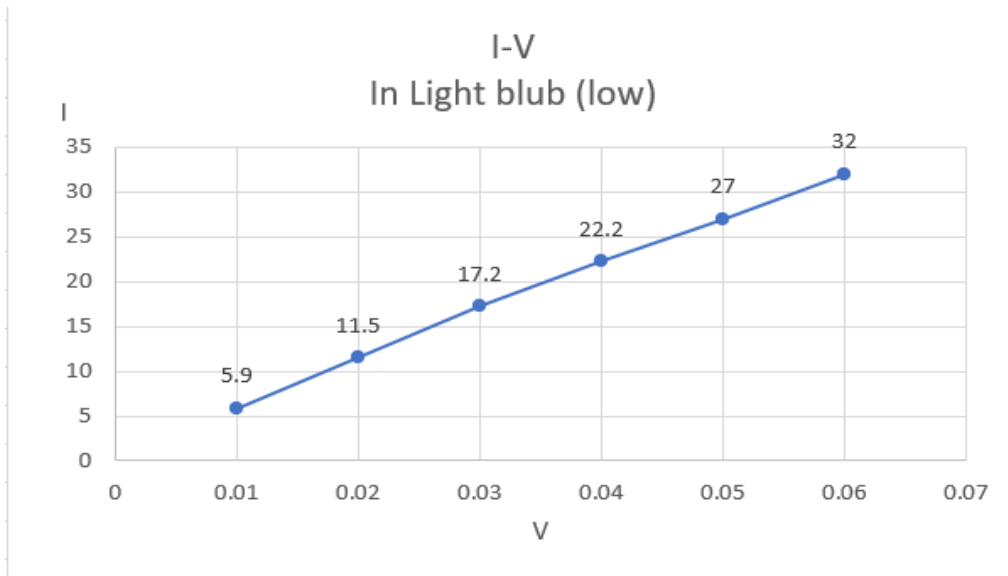
$$R = R_0 [1 + \alpha (T - T_0)]$$



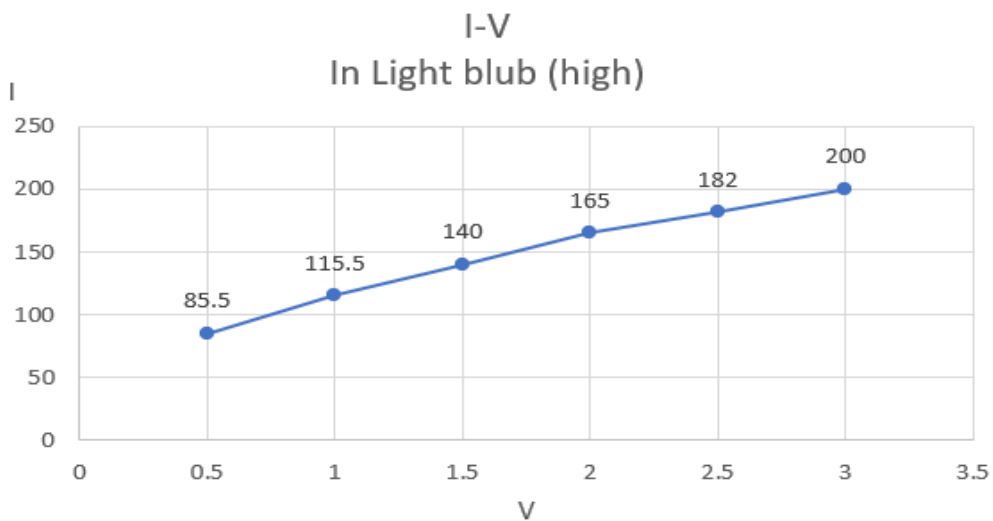
This is a graph for carbon resistance. And we conclude from the figure that the relationship is linear.



This is a graph for Si diode. And we conclude from the figure that the relationship is non-linear.



This is a graph for Light bulb (low). And we conclude from the figure that the relationship is linear.



This is a graph for Light bulb (high). And we conclude from the figure that the relationship is non-linear.

Calculations:

Results & Conclusion:

- The carbon resistor is a linear component.
- The diode is non-linear.
- the light bulb with high current non-linear while starting to turn on because of the increase of temperature, and then obtains a linear resistance after a while, but light bulb with low current linear

So, the Diode and the light bulb are non-linear components, and don't obey Ohm's law.