Current and Circuits

I. Current and Power
   - the ampere

II. Ohm's Law and Resistance
   - the ohm
   - resistors

III. Series and Parallel Circuits
   - applications

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	The student will be able to:	HW:
1	Define electric current and the Ampere and solve problems relating current to charge and time. ✓	1 – 3
2	Solve problems involving electric power. ✓	4 – 10
3	Define resistance and the ohm and solve problems using Ohm's Law to relate voltage, current, and resistance.	11 – 23
4	Calculate the effective total resistance for multiple resistors connected in series or parallel and analyze DC circuits consisting of a combination of series and parallel branches of resistors and/or voltage sources, determining voltage and current for each element.	24 – 37

What is Electrical Resistance?

When we speak of electrical resistance we mean resistance to the flow of charge (*i.e.* resistance to current).

Accordingly, conductors have very low resistance and insulators have very high resistance.

Some materials, such as semiconductors, have a resistance that varies depending on certain conditions.

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Definition of Resistance

For most materials it requires greater electric potential to produce greater current.

However, the resulting current also depends on resistance. The greater the resistance, the greater the potential required to produce a *certain level* of current.

Resistance is defined as the ratio of potential difference to current.

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Definition of Resistance

$$R = \frac{V}{I}$$

where: R = resistance
V = electric potential "across"
I = electric current "through"

More commonly written as:

$$V = IR$$

(often referred to as Ohm's Law)

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Units of Resistance

- The SI unit for electric resistance is the **ohm**.
- One ohm is equal to one volt per one ampere:

$$1\ \Omega = 1\ \text{V/A}$$

- The greater the number of ohms, the more volts it takes to achieve one ampere of current – *i.e.* "More volts per ampere means more resistance and therefore more ohms".

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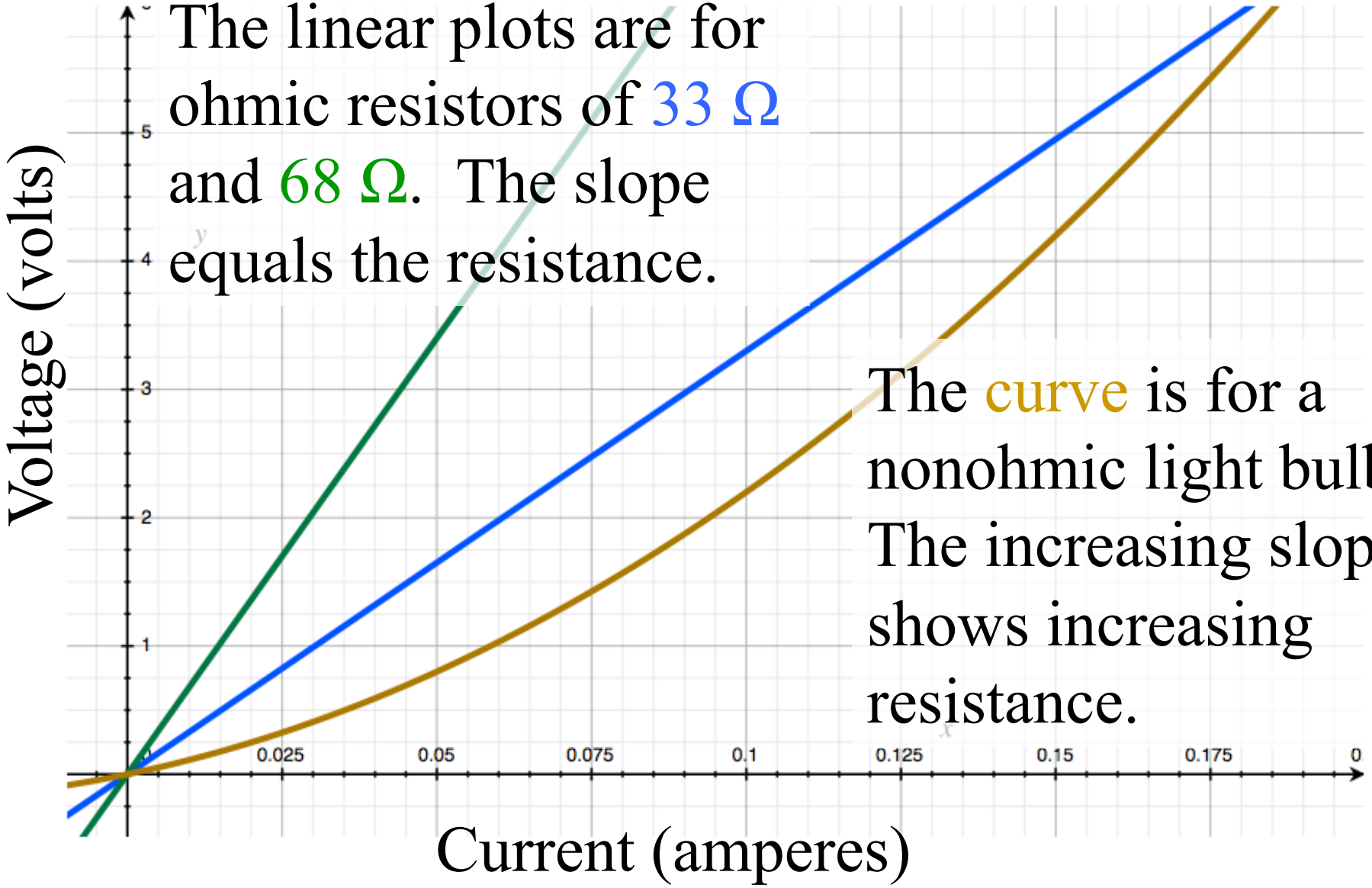
Ohm's Law

In the 1820's, Georg Ohm found that the ratio of voltage to current is constant over a wide range of conditions for metals and many other substances.

Such a substance has a **constant resistance** and is said to be **ohmic**.

However, there are materials and devices that do not have a constant resistance. These are said to be **nonohmic**.

Voltage vs. Current for Resistors and Bulb



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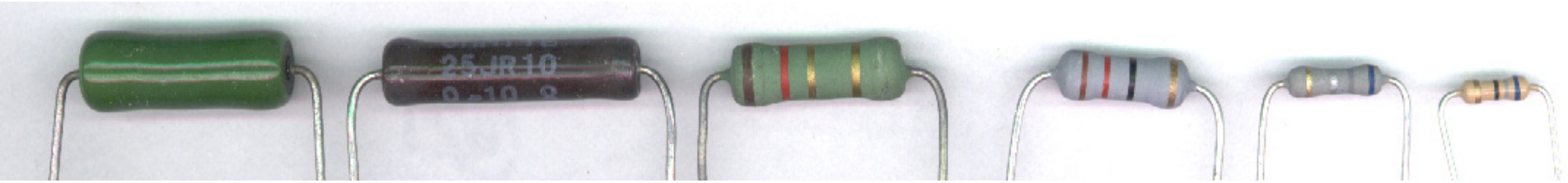
Resistors



- A resistor is a device designed to have a particular amount of resistance.
- A resistor is designed to be ohmic and therefore has the same resistance over a wide range of operating conditions.

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