Topic 3 - Resisting the Movement of Charge

Resistance is a measure of how difficult it is for the electrons to flow through a conductor. Resistance also converts electric energy into other forms of energy. Generally, it can be said that conductors have *low resistance* and insulators have *high resistance*. The standard unit for resistance is *ohm* (Ω). Resistance can be measured directly with an *ohmmeter*, but a *multi-meter* is used more often to measure resistance.

Calculating Resistance

Electrical resistance is calculated by finding the ratio of the *voltage* across the load (V) to the *current* through the load (I). This is called ***Ohm's Law***. $R = V / I$

The more resistance a substance has, the greater the energy gain it receives from the electrons that pass through it. The energy gain is evident in heat and light energy (light bulb filament, wire in a toaster). Solutions can also be resistors. 'Lie detectors' are also special applications of resistance within the body (skin resistance, blood pressure and respiration). An increase in stress (usually associated with a lie) will improve conductivity and show a 'peak' in the recording device. If the temperature of a resistor changes, the resistance changes as well (resistance is usually low when the resistor is cool, and as the temperature increases, so does resistance).

Model Problem - Applying Ohm's Law - Sample textbook problems ***p. 282***

Resistors

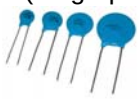
Different resistors are used for different applications, especially in electronics. There are many styles, sizes and shapes. The major application for resistors is to control current or voltage to suit the specific needs of other electrical devices within the same circuit. The two most common resistors are the wire-wound and carbon-composition types. The colored strips on a resistor usually indicate the level of resistance and quality.

Variable Resistors

To change electron flow gradually, a variable resistor, or *rheostat* is used (a dimmer switch, volume control knob).

Rheostats (dimmer) Thermistor (heat-sensitive) Varistors (surge-protector)





Types of Circuits

http://www.autoshop101.com/trainmodules/elec_circuits/circ101.html

A *series circuit* provides only one path for the current to flow.

A *parallel circuit* provides multiple pathways.

House Wiring

Practical wiring in the home uses parallel circuits. The voltage across each load is the same, and by turning on one appliance in the circuit, the energy will not be reduce to the other devices. Caution – current through wires connected to the source increases whenever another branch in the circuit is closed.

- *Factors that affect the Resistance of Wire*

Factor	***Effect***
Length -	Resistance increases with length
Cross-section area -	Resistance decreases with area (gauge – AWG #)
Temperature -	As temperature increases, resistance increases
Material -	Determined by the structure of the atoms in the material

Power cables are composed of many thin copper stands, separated in groups by paper insulation, and covered by a rubber insulation material, which reduces resistance and heating in the cable, while still making it flexible enough to handle.