Chapter 17

Current and Resistance

Current is represented by "I" and has the units of Amperes or amps.

I=Q/t Q is amount of charge in Coulombs and t is time in seconds.

The direction of current flow is the direction a positive change would flow; that is from the positive to negative terminal of a battery within a circuit. It does not get "used up".

1.6 X 10^{-19} C/1 electron

Drift speed (velocity root mean square or average speed between collisions)-current is not a smooth flow of charged particles, but rather a zigzag motion along the wire as they collide with the metal atoms. Note the formulas as this relates to thermal physics:

$v_{rms}=\sqrt{(\frac{3RT}{M})}=\sqrt{(3kT/\mu)}$

R is universal gas constant, 8.31 J/(mol K), T is temperature in Kelvin, and m is mass in kg.

k is Boltzman's constant = 1.38 X 10^{-23} J/K, T is temp. in Kelvin, and μ is mass of molecule in kg.

A circuit diagram is a closed loop figure representing an actual circuit. To be studied in great detail, Chapter 18.

A multimeter is a combination of an ammeter (measures current) and a voltmeter (measures voltage).

Ohm's Law V=I/R V is voltage or electric potential difference in volts, I is currents in amps, and R is resistance in ohms. Resistance units, ohms, is represented with the greek symbol, upper case omega, Ω.

A resistor (R) is a conductor of some sort that draws down a voltage.

A diode is a one-way valve for current.

Resistivity-physical constant of a material which is measured in ohm-meters and is represented by the symbol, rho, φ. This value depends on material's electronic structure and on temperature. Good electric conductors have low resistivity and visa versa for poor conductors.

R=φl/A where R is resistance in ohms, φ is resistivity in ohm-meters, l is length in m, and A is cross-sectional area in m^2. R/l is resistance per unit length = φ/A.

There can be variation in R and φ due to temperature. As temperature increases, φ increases and so does R. A charge moving through metal atoms makes more collisions with increasing temperature because the particles are scattered and harder to get around because they are vibrating with larger amplitudes.

P is variable for power. Power is the rate at which energy is delivered to a resistor.

$P=IV=I^2R=V^2/R$

Unit of Power is J/s or Watt.

1 kWatt-hour=3600000 J