Electron Flow and Resistance:
Resistance (R) and Conductance (G)

Session 1b of Basic Electricity
A Fairfield University E-Course
Powered by LearnLinc

Basic Electricity

Two Sections

- Electron Flow and Resistance
  - 5 on-line sessions
  - Lab
- Inductance and Capacitance
  - 5 on-line sessions
  - Lab

Mastery Test, Part 1

Basic Electricity (Continued)

- Text: "Electricity One-Seven," Harry Mileaf, Prentice-Hall, 1996, ISBN 0-13-889585-6 (Covers several Modules and more)
- References:
  - "Digital Mini Test: Principles of Electricity Lessons One and Two," SNET Home Study Coordinator, (203) 771-5400
  - Electronics Tutorial (Thanks to Alex Pounds at alex_tb@hotmail.com)
  - Electronics Tutorial (Thanks to Mark Sokos at sokos@desupernet.net)

Section 1:
Electron Flow and Resistance

- 0BJECTIVES: This section introduces five basic electrical concepts as well as the underlying atomic structure of electrical materials.
  - Conductance(G),
  - Resistance (R),
  - Current (I),
  - Power (P), and
  - Electromotive force (E) or voltage (V).

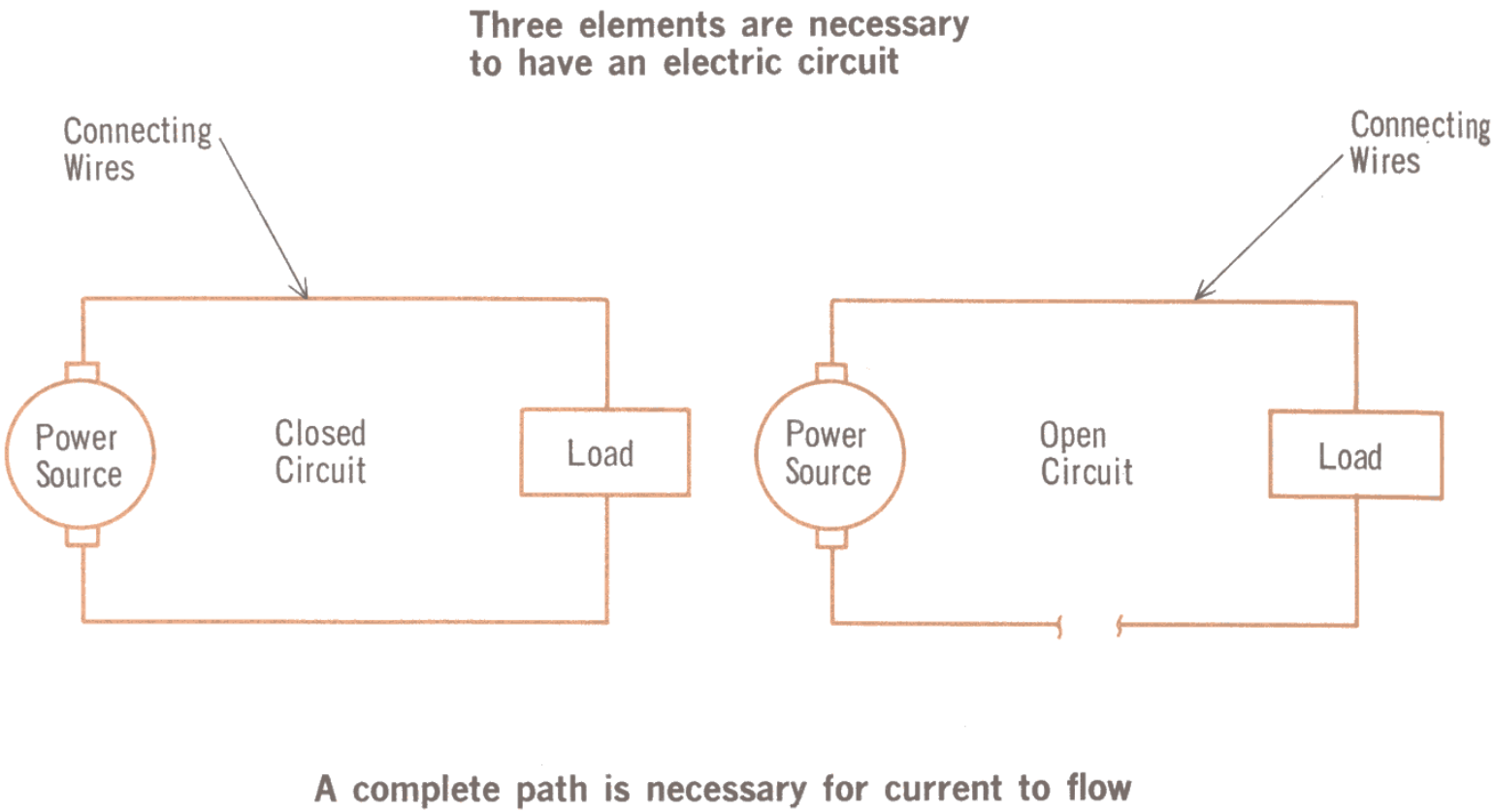
Section 1 Schedule:

Session a – 03/04 *03/06 & 03/08 were Math Tutorials*	Atoms, Charge and Current	Text 1.1 – 1.39
	Conductivity (G), Electric Fields and Electromotive Force (EMF)	Text 1.40 – 1.68
Session b – 03/11	**Resistance (R), Conductance (G), Ohms Law (Ω) & Power (Watts)**	**Text 2.1 – 2.52**
Session c – 03/13 (lab - 03/16, sat.)	Resistors in Series and Parallel (Working with Equations)	Text 2.53 – 2.98
Session d – 03/18	Series / Parallel Simplification Kirchoff, Thevenin, Norton	2.99 – 2.115 2.116 – 2.133
Session e – 03/20	Review: The Water Model	1.42, 1.63, 2.5, 2.129 Sokos

Lesson 1a Review

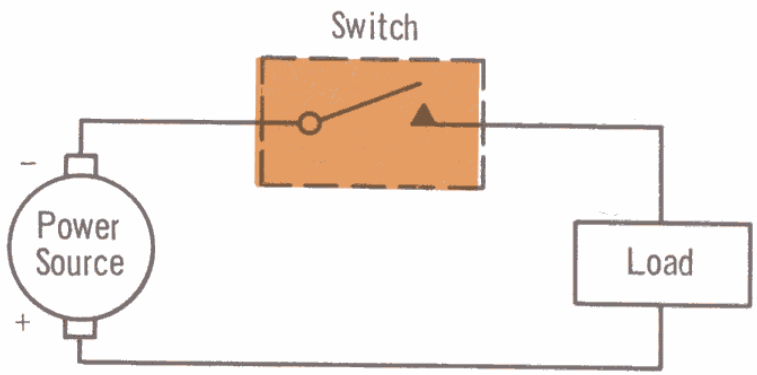
- Charge (Coulombs)
- Current (Amperes)
- Voltage (Volts)
- Conductivity/Resistivity
- Electric Fields (Volts/Meter)
  - Coulomb's Law

Circuits

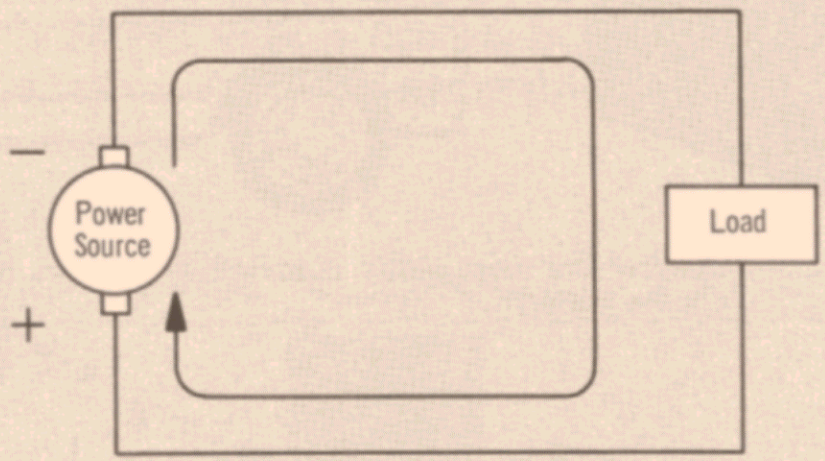

Three elements are necessary
to have an electric circuit
Connecting
Wires
Power
Source
Closed
Circuit
Load
Connecting
Wires
Power
Source
Open
Circuit
Load
A complete path is necessary for current to flow

Switches

All switches perform the same basic function of opening and closing electric circuits



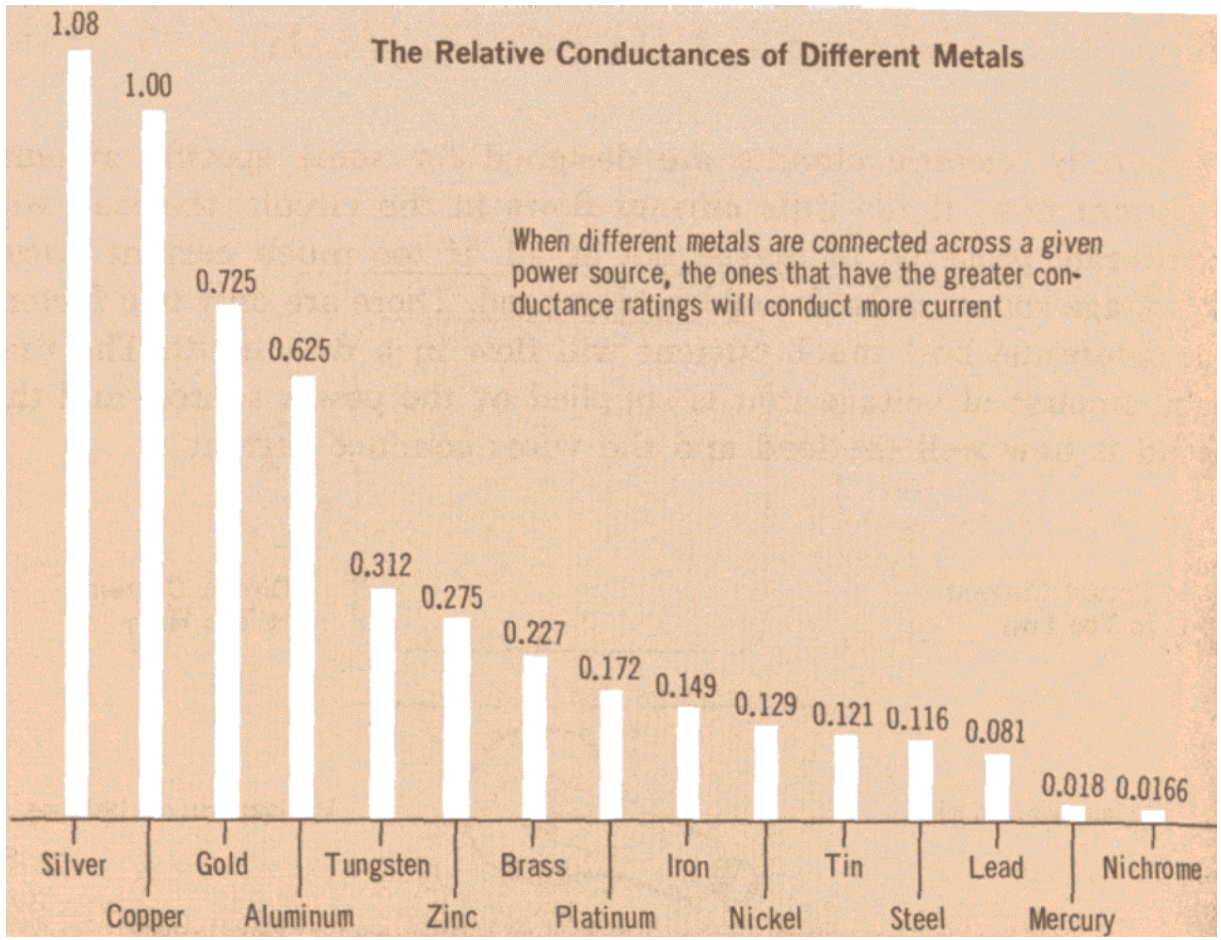
Direct Current



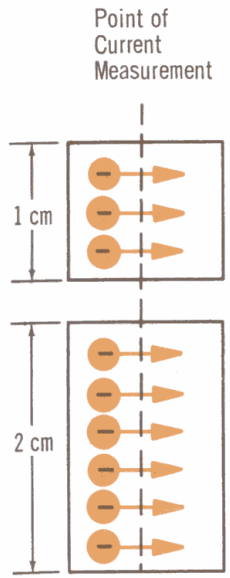
Electrons (Current flows the opposite direction)

~~Current~~ flows from the negative terminal of the source, through the load, and back to the positive terminal of the source. If the polarity of the source voltage does not alternate, then direct current flows. This is a d-c circuit

Conductors

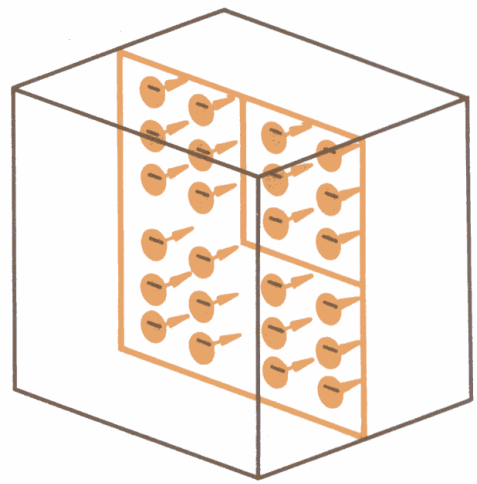

The Relative Conductances of Different Metals
When different metals are connected across a given power source, the ones that have the greater conductance ratings will conduct more current
1.08
1.00
0.725
0.625
0.312
0.275
0.227
0.172
0.149
0.129
0.121
0.116
0.081
0.018
0.0166
Silver
Copper
Gold
Aluminum
Tungsten
Zinc
Brass
Platinum
Iron
Nickel
Tin
Steel
Lead
Mercury
Nichrome

Resistance

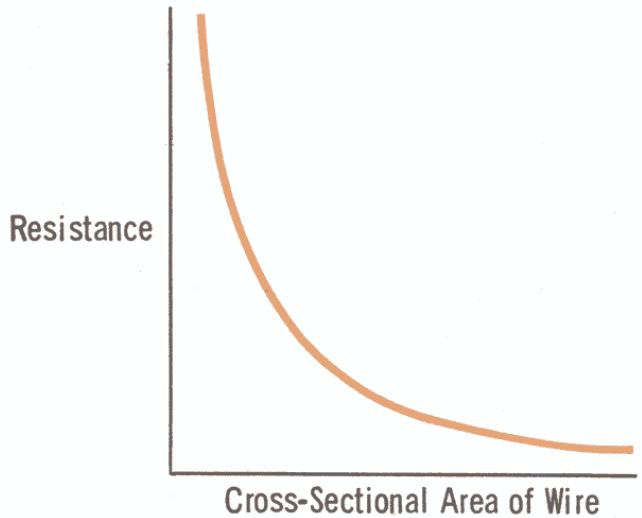


When a conductor is made thicker, it will conduct more current and will have less resistance

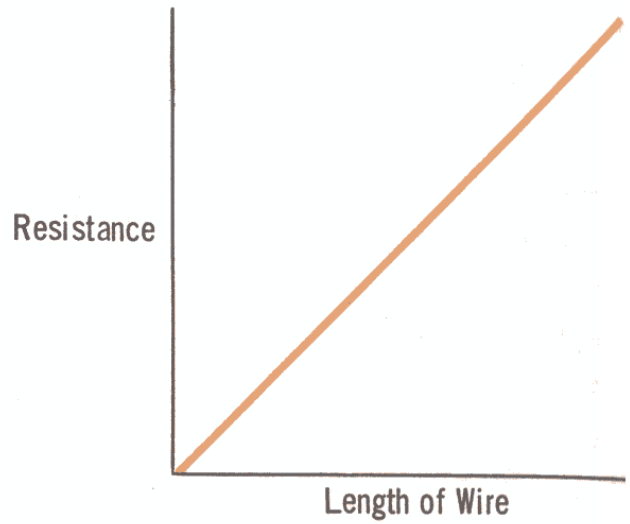
Conductors with greater cross-sectional area have more free electrons available, and, therefore, have less resistance



Resistance
(continued)

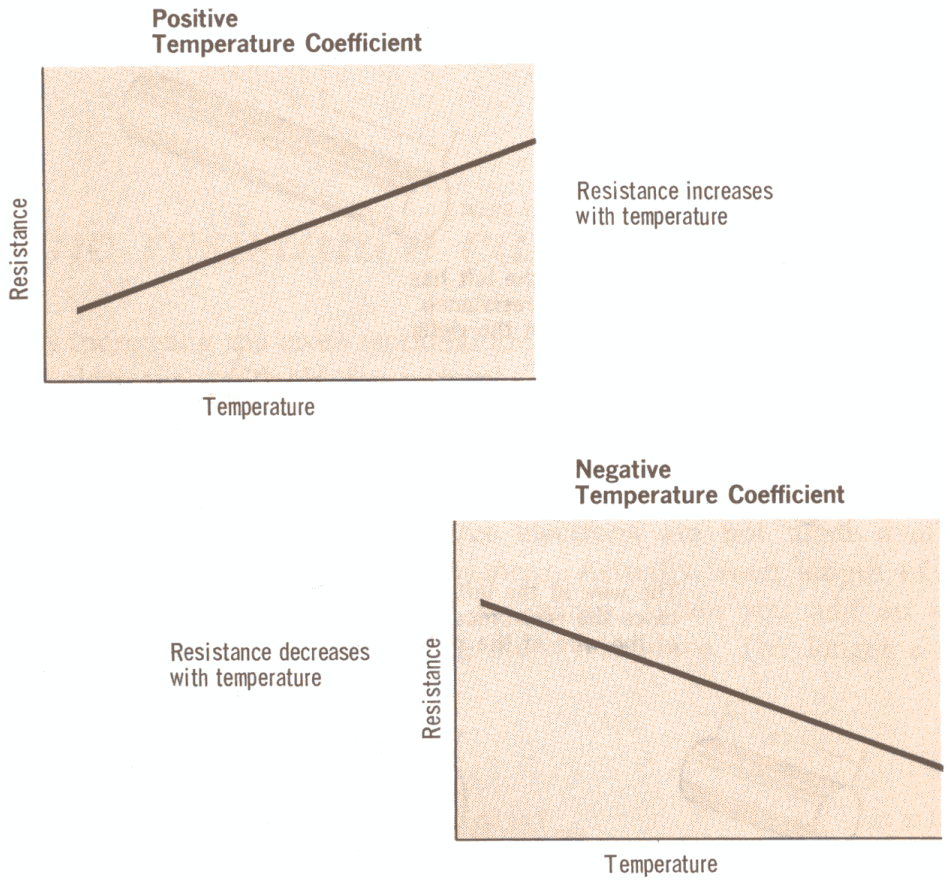


Increasing the cross-sectional area of a wire decreases its resistance



Increasing the length of a wire increases its resistance

Temperature effects



Resistors

- A constriction in the flow of current
- Analogous to a small orifice in a water pipe, it takes a high pressure (voltage) to force a flow of water (current) through the resistance.
- Ohm's Law

  $V=I*R$ $I=V/R$ $R=V/I$

Resistor Color Codes

- First two stripes: Digits
- Third stripe: Power of 10
- Fourth stripe: Precision
  (none - 20%, silver - 10%, gold - 5%)

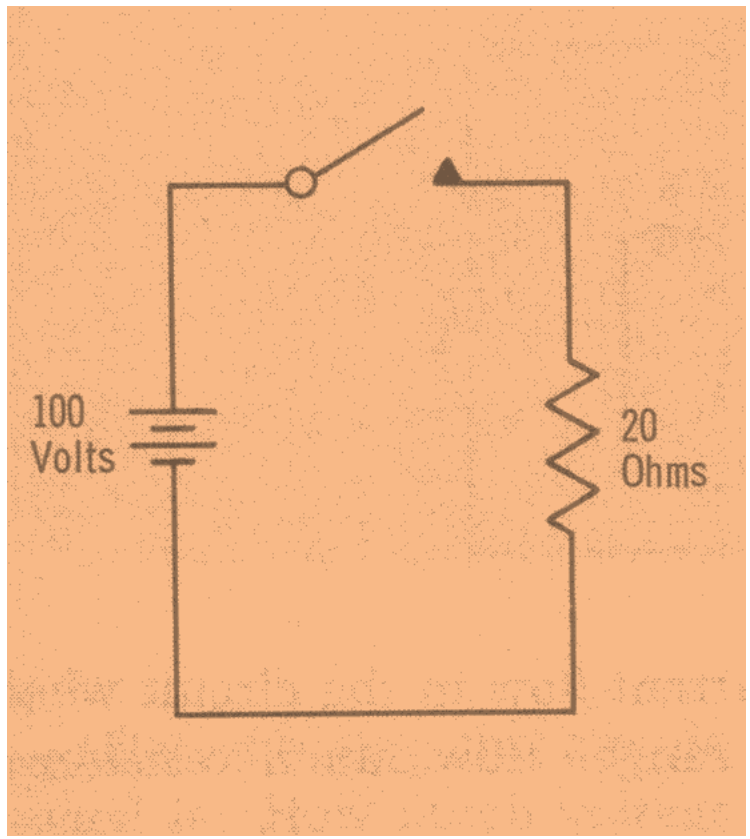
0 - Black	5 - Green
1 - Brown	6 - Blue
2 - Red	7 - Violet
3 - Orange	8 - Gray
4 - Yellow	9 - White

An Example

I = V/R

I = 100/20

I = 5 amps



Power

- Power is a measure of work
- $P = V*I = V^2/R = I^2*R$
- Power is measured in Watts (James Watt)

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