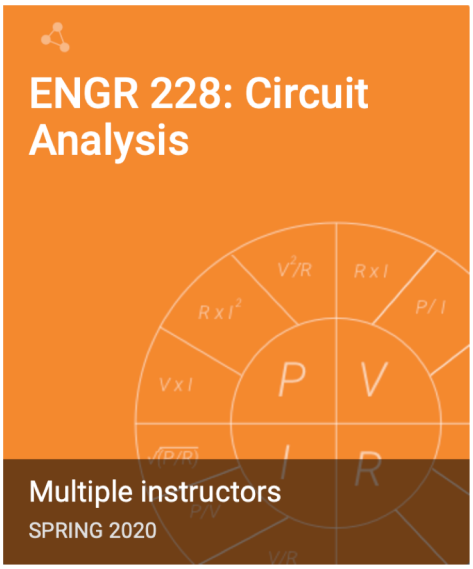


Chapter 2.1

Resistive Circuits

Ohm's Law

Engr228 - Circuit Analysis

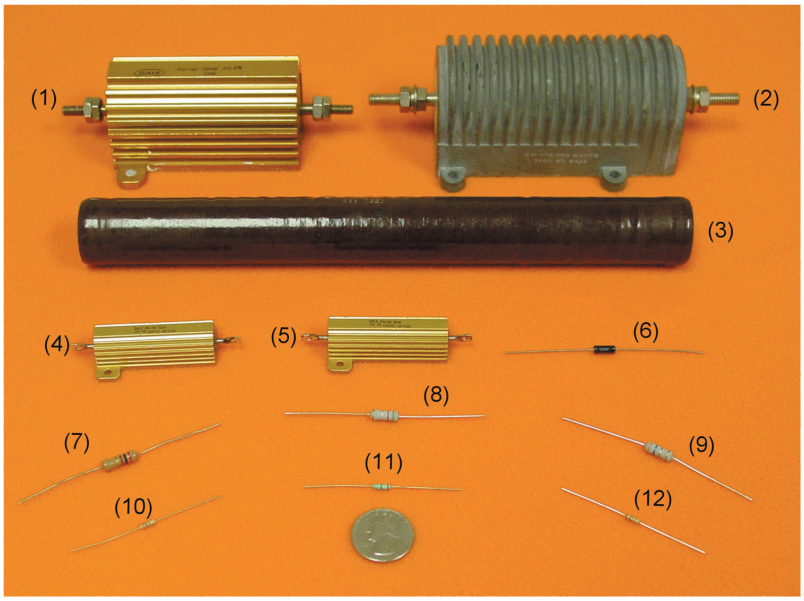
Spring 2020

Dr Curtis Nelson

Section 2.1 Objective

- Learn to apply Ohm's law.

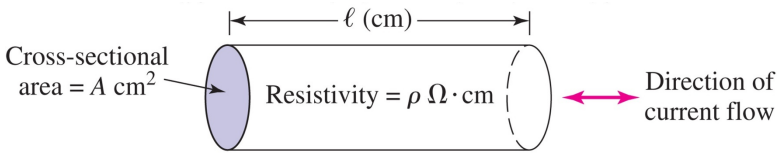
Resistors



Wire Gauge and Resistivity

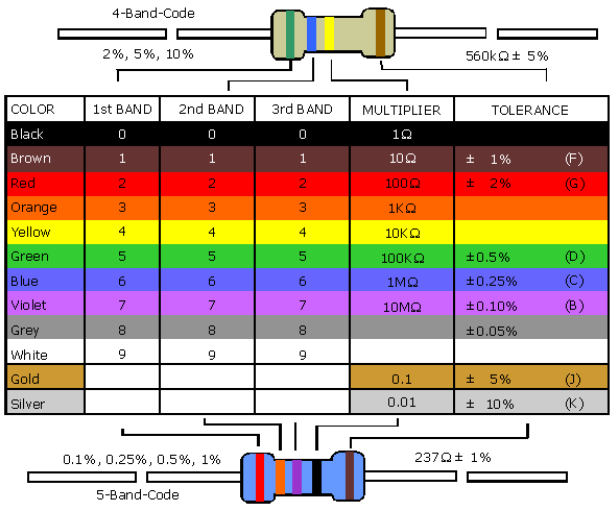
- The resistance of a wire is determined by the resistivity of the conductor as well as the geometry:

$$R = \rho \, l / A$$



- In most cases, the resistance of wires can be assumed to be 0 Ω.

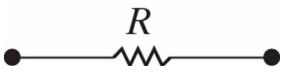
Resistor Color Code Chart



COLOR	1st BAND	2nd BAND	3rd BAND	MULTIPLIER	TOLERANCE	
Black	0	0	0	1Ω		
Brown	1	1	1	10Ω	± 1%	(F)
Red	2	2	2	100Ω	± 2%	(G)
Orange	3	3	3	1KΩ		
Yellow	4	4	4	10KΩ		
Green	5	5	5	100KΩ	±0.5%	(D)
Blue	6	6	6	1MΩ	±0.25%	(C)
Violet	7	7	7	10MΩ	±0.10%	(B)
Grey	8	8	8		±0.05%	
White	9	9	9			
Gold				0.1	± 5%	(J)
Silver				0.01	± 10%	(K)

Resistance (R) and Conductance (G)

- *Resistance* (R) is the capacity of a material to impede the flow of current.
- More current will flow if there is less resistance.
- *Conductance* (G) is the inverse of resistance.
- The *unit* of resistance is the ***ohm*** **(R),** has the symbol **Ω,** and has units of (volts/amp).
- The circuit symbol used for a resistor of *R* ohms is:



Ohm's Law

- The relationship between voltage, current, and resistance is defined by *Ohm's law* which states that

$$V = IR$$

where

V = the voltage in volts;

I = the current in amps;

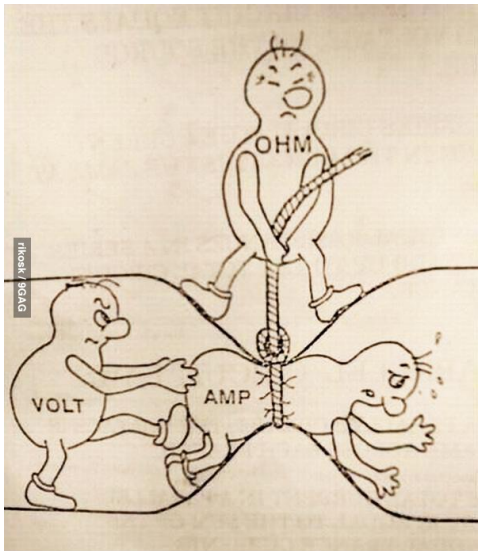
R = the resistance in ohms.

Other Forms of Ohm's Law

- Ohm's law can be expressed in any one of three forms, depending on which quantities are known:

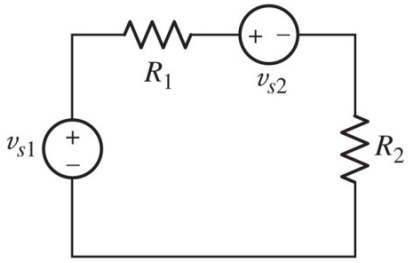
V = IR	(I and R known)
I = V/R	(V and R known)
R = V/I	(V and I known)

Ohm's Law Illustrated



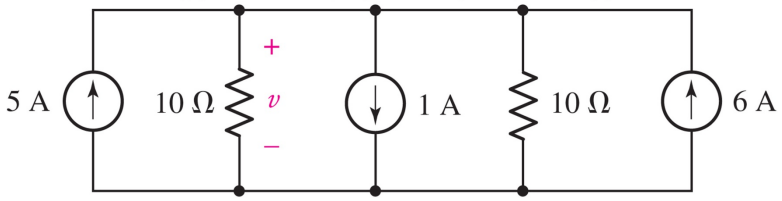
Series Connections

- Elements connected head-to-tail and carrying the same current are said to be connected in ***series.***



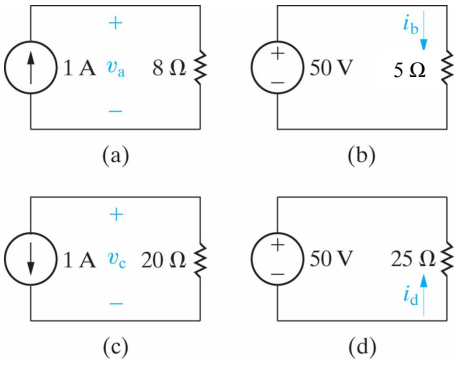
Parallel Connections

- Elements in a circuit connected head-to-head and tail-to-tail have a common voltage across them and are said to be connected in ***parallel.***



Ohm's Law Examples

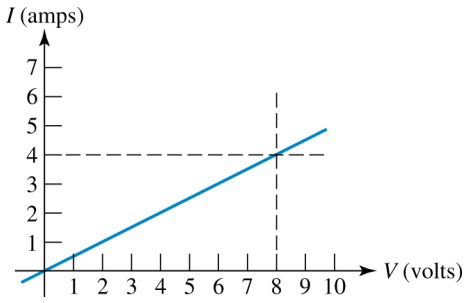
Using Ohm's law, calculate the values of v and i in the examples below and determine the power dissipated in each resistor.



a) $v_a = 8V$ p = 8W
b) $i_b = 10A$ p = 500W
c) $v_c = -20V$ p = 20W (positive)
d) $i_d = -2A$ p = 100W

Ohm's Law Example

Calculate the value of R from the information shown in the graph below:



R is the inverse of the slope of the line:

R = V/I = (8V)/(4A) = 2Ω

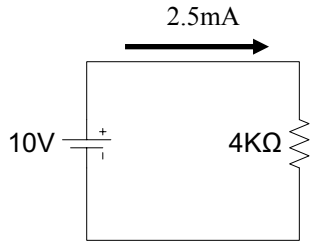
Power and its Alternate Forms

- Resistors ***always*** absorb power:

$$p = vi = v^2/R = i^2R$$

Power Example

Calculate the power absorbed or generated by both elements in the circuit below:

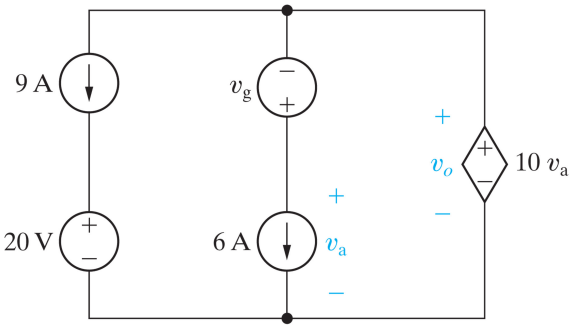


- Resistor absorbs power: 10V * 2.5mA = 25mW
- DC source generates power: 10V * -2.5mA = - 25mW
- Sum of all power in a circuit must = 0

Note: Resistors always absorb power but DC sources can either generate or absorb power.

Textbook Problem 2.9 (Nilsson 11E)

Find the total power developed in the circuit if $v_o = 5$ V.



$P_{9A} = -135$W $P_{20V} = 180$W $P_{10va} = -75$W
$P_{vg} = 27$W $P_{6A} = 3$W
$P_{total} = 210$W and generated power = absorbed power

Section 2.1 Summary

- Section 2.1: You learned to apply Ohm's law.