11.5 - Resistor Circuits

Resistor Codes
Resistors have a printed resistance that at-a-glance tells what its resistance value is (see Resources 8).
The first and second bands (read from closest band end of resistor) are two numbers.
The third band is a multiplier.
The fourth is a +/- tolerance band.

Resistance = 270 +/- 13.5 Ω

Resistor Code Examples
What are the values of the following resistors?
1. brown-black-blue-gold 10 megaohms
2. orange-blue-brown-gold 360 ohms

Calculating Series Resistance
Series resistance ($R_s$) calculation:

$$R_s = R_1 + R_2 + R_3...$$

Resistance is additive - current travels through more obstacles.

$$R_s = \sum R_i$$

AP Equation

i = individual

3. Series Example
What is the resistance of the circuit?
What's the power dissipated?

$$R_s = R_1 + R_2 + R_3 + ...$$

$$R_s = 47Ω + 23Ω + 20Ω = [90Ω]$$

Power:

$$P = \frac{V^2}{R} = \frac{(6.0V)^2}{90Ω} = 0.40W$$
**Calculating Parallel Resistance**
There are more paths for current: overall resistance is less. 

\[ R_p = \left( R_1^{-1} + R_2^{-1} + R_3^{-1} + \ldots \right)^{-1} \]

\[ R_p \text{ is always less than the lowest resistor.} \]

The 1/x button on your calculator is useful!

\[ \frac{1}{R_p} = \sum \frac{1}{R_i} \text{ AP Equation} \]

\[ R = \text{Resistance} \]

\[ i = \text{individual} \]

\[ R = \frac{1}{\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots} \text{ Not user friendly!} \]

**Mixed Circuits: Series & Parallel**
In a mixed circuit, sequentially reduce series/parallel sections, until the total resistance is reduced to one equivalent resistance \( R_{eq} \).

1. Parallel Part
2. Serial Part
3. \( R_{eq} = \) Equivalent Resistance

**Mixed Example**
Consider this circuit:

5. What is the equivalent resistance in the circuit?
6. What current will flow through the circuit if the resistors are connected to a 12 V battery?

**Mixed Example**

5. First, solve the two parallel portions of the circuit.

\[ R_p = \left( R_1^{-1} + R_2^{-1} \right)^{-1} \]

\[ = \left( 10 \Omega^{-1} + 10 \Omega^{-1} \right)^{-1} = 5 \Omega \]

6. Total current?

\[ V = IR \]

\[ I = \frac{V}{R} = \frac{12 V}{10 \Omega} = 1.2 \text{ A} \]

**Homework**
11.5 Problems.
Due: Next Class.