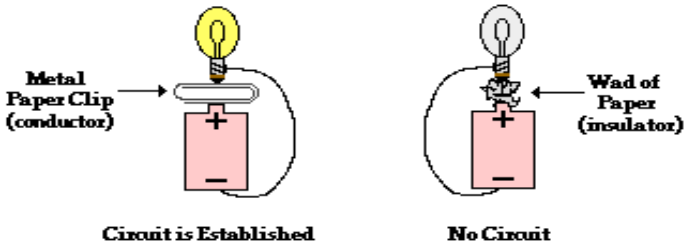
Physics **Name**_____

Unit 4 – Electric Circuit Notes **Date** _____ **Block**___

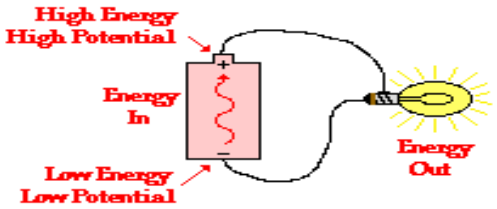
Requirements for an Electric Circuit

1. There must be a _____ conducting path which extends from the _____ terminal to the _____ terminal.



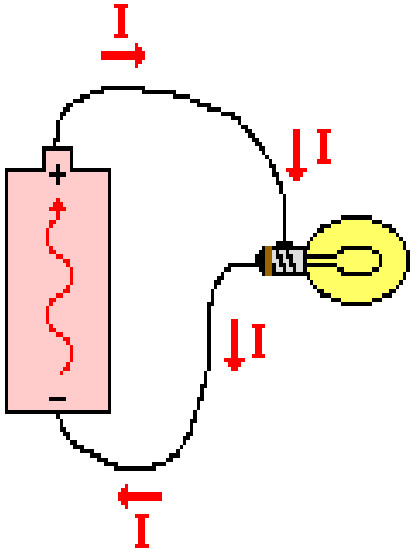
2. All connections must be complete and made by _____ materials capable of _____ charge.

3. There must be an _____ capable of doing _____ on a charge to move it from a _____ location (negative terminal) to a _____ location (positive terminal).
   - *This establishes an electric potential difference across the two ends of the external circuit.*



Circuit Vocabulary

- **Current**
  - Current is the _____ of _____
    - *# of charges that pass per second*
  - Symbol:
  - Units:
  - The _____ of an electric current is, by _____, the direction in which a _____ charge would move if placed in the circuit.



- **Voltage**
  - Also defined as electric potential, is the _____ per unit of _____
    - *Energy in a unit of charge*
  - Symbol:
  - Units:

- **Resistance**
  - A _____ to the flow of charge.
  - Symbol:
  - Units:

Circuit Symbols

- Battery or DC Power Supply
- Wire
- Switch
- Ammeter
- Voltmeter
- Resistor

Ohm's Law

- Current is _____ to Voltage.
  - *If you double voltage, current will*_____.
  - *If you cut voltage in 1/3, current will* _____.
- Current is _____ to Resistance.
  - *If you double resistance, current will* _____.
  - *If you cut voltage in 1/4, current will* _____.
- **Formula:**
- **Examples:**
  - Practice 1: An automobile headlight with a resistance of 30 ohms is placed across a 12-volt battery. What is the current through the circuit?
  - Practice 2: A lamp draws a current of 0.50 amps when it is connected to a 120-V source. What is the resistance of the lamp?
  - Practice 3: A lamp with a resistance of 30 **Ω** is connected to a voltage source. The current in the circuit is 3.0 A. What is the voltage of the source?

Power

- Measure the _____ at which energy is _____ or _____ from one form of energy to another.
    - *How fast work is being done!*
    - Symbol:
    - Units:
    - **Formula(s):**

Energy

- The amount of _____ being _____ and how _____ it's being used for.
    - Symbol:
    - Units: 1) *if no mention of a time unit:*

      2) *if hours mentioned (energy company):*

    - **Formula(s):**

Power & Energy Practice Problems

- A 6.0-V battery delivers a 0.50-A current to an electric motor that is connected across its terminals.
    - What is the power consumed by the motor?
    - If the motor runs for 5.0 minutes, how much electrical energy is delivered?

- A 60 W light bulb is on an average of 7 hours a day.
    - How much energy is used in kilowatt hours (kWh)? 1000 W = 1 kW
    - If it costs $0.06 per kWh, how much does running this bulb cost per day? Per month (assume 30 days)?

Series Circuits

- There is only _____ for the current to flow.
- Current is the _____ throughout the circuit.
- Resistance _____.
- Voltage _____.
- **Examples:**
  - Example 1: Three 20-Ω resistors are connected in series across a 120-V generator.

a) Draw the circuit
b) What is the equivalent (total) resistance?
c) What is the current in the circuit?
d) What is the potential drop (voltage) across each resistor?

  - Example 2: A 3 Ω, 4 Ω and 7 Ω resistor are connected in series across a 12-V battery.

a) Draw the circuit
b) What is the equivalent (total) resistance?
c) What is the current in the circuit?
d) What is the potential drop (voltage) across each resistor?
e) What is the power at each resistor?
f) What is the total power of the circuit?

  - Example 3: Four resistors, 45-Ω, 5-Ω, 30-Ω, and 40-Ω are connected in series across a 240-V generator.

a) What is the equivalent (total) resistance?
b) What is the current through the entire circuit?
c) What is the potential drop (voltage) across each resistor?
d) What is the power at each resistor?
e) What is the total power of the circuit?

  - Example 4: Two resistors, 10-Ω and 30-Ω are connected in series across a 20-V battery.

a) What is the equivalent (total) resistance?
b) What is the current through the entire circuit?
c) What is the potential drop across each resistor?
d) What is the power drawn by each resistor?
e) What is the total power of the circuit?

Parallel Circuits

- There are _____ for the current to flow.
- Current _____.

- Equivalent (total) Resistance is always _____ than the smallest resistor.

- Voltage is the _____ throughout the circuit.

- **Examples:**
  - Example 1: A 120-Ω resistor, a 60-Ω resistor and a 40-Ω resistor are connected in parallel across a 12-V generator.

a) Draw the circuit
b) What is the equivalent (total) resistance?
c) What is the current through the entire circuit?
d) What is the current through each branch of the circuit?

  - Example 2: Two resistors, 45-Ω and 5-Ω, are connected in parallel across a 90-V generator.

a) Draw the circuit
b) What is the equivalent (total) resistance?
c) What is the current through the entire circuit?
d) What is the current through each branch of the circuit?
e) What is the power at each resistor?
f) What is the total power of the circuit?

  - Example 3: Three resistors, 3-Ω, 12-Ω and 6-Ω, are connected in parallel across a 30-V generator.

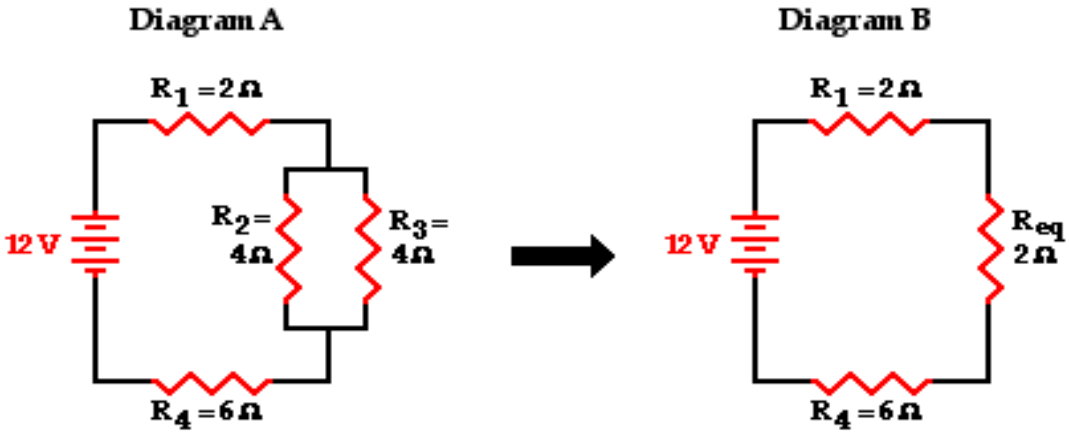
a) Draw the circuit
b) What is the equivalent (total) resistance?
c) What is the current through the entire circuit?
d) What is the current through each branch of the circuit?
e) What is the power at each resistor?
f) What is the total power of the circuit?

  - Example 4: Two resistors, 24-Ω and 72-Ω, are connected in parallel across a 54-V generator.

a) Draw the circuit
b) What is the equivalent (total) resistance?
c) What is the current through the entire circuit?
d) What is the current through each branch of the circuit?
e) What is the power at each resistor?
f) What is the total power of the circuit?

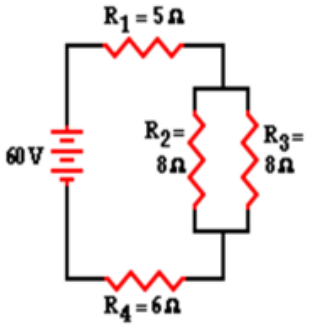
Combination Circuits – *HONORS ONLY*

- The use of both _____ and _____ connections within the same circuit.
- Use the meaning of _____ for parallel branches to _____ the combination circuit into a _____ circuit.



- **Examples:**

Combination Example1



R_{tot} = _____ I_{tot} = _____

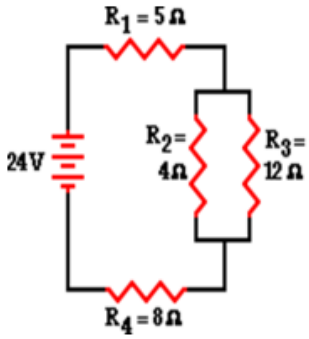
I_1 = _____ ΔV_1 = _____

I_2 = _____ ΔV_2 = _____

I_3 = _____ ΔV_3 = _____

I_4 = _____ ΔV_4 = _____

Combination Example 2



R_{tot} = _____ I_{tot} = _____

I_1 = _____ ΔV_1 = _____

I_2 = _____ ΔV_2 = _____

I_3 = _____ ΔV_3 = _____

I_4 = _____ ΔV_4 = _____