

### Series Circuits

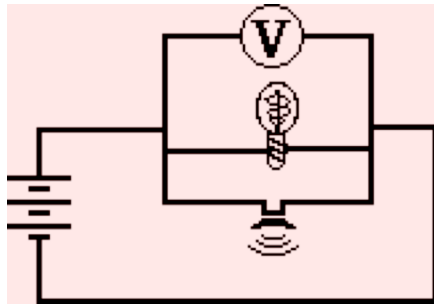
Read from **Lesson 4** of the **Current Electricity** chapter at **The Physics Classroom**:

<http://www.physicsclassroom.com/Class/circuits/u914a.html>

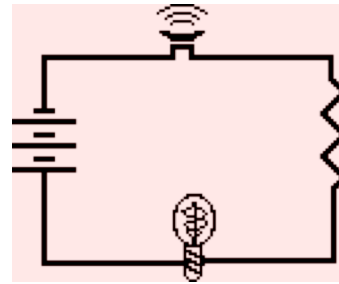
<http://www.physicsclassroom.com/Class/circuits/u914b.html>

**MOP Connection:** Electric Circuits: sublevels 7, 9 and 11

- Electrical devices in circuits can be connected to each other in a number of different ways. The two most common connections are *series* connections and *parallel* connections. Observe the electrical wiring below. Indicate whether the connections are series or parallel.

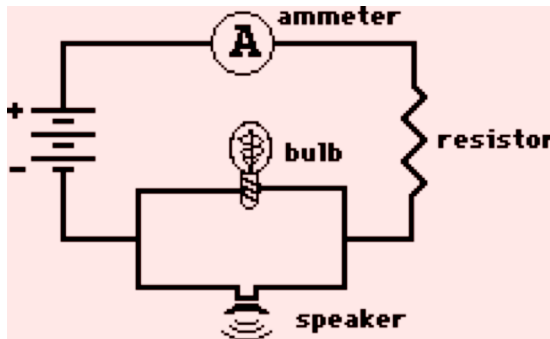


Series or Parallel?



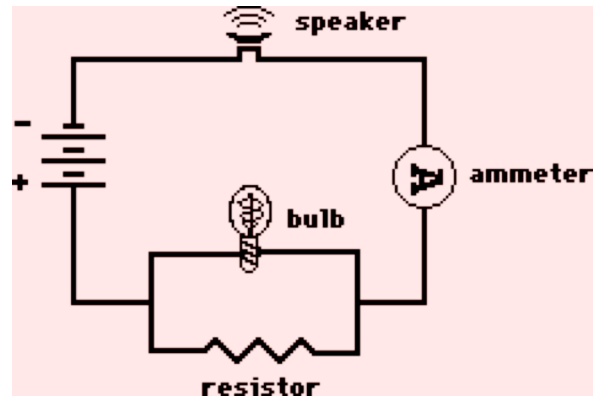
Series or Parallel?

- Two electric circuits are diagrammed below. For each circuit, indicate which two devices are connected in series and which two devices are connected in parallel.



Series \_\_\_\_\_

Parallel \_\_\_\_\_



Series \_\_\_\_\_

Parallel \_\_\_\_\_

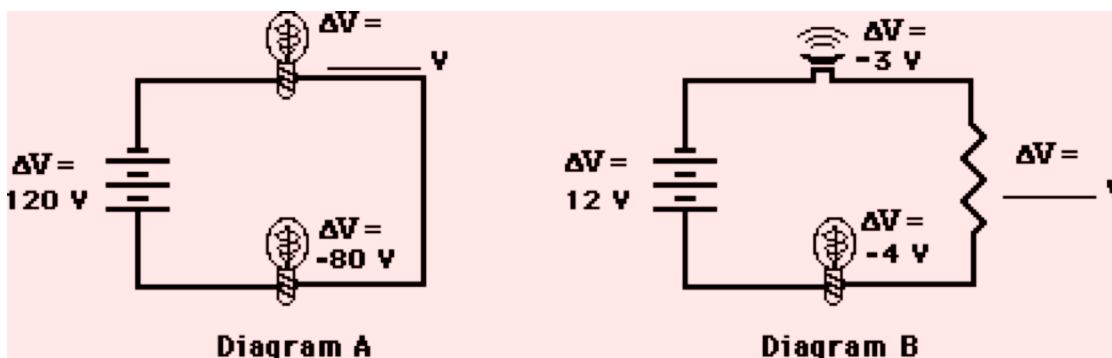
- Comparing Series vs. Parallel Circuits**

Fill in the table below to indicate the manner in which series and parallel circuits differ.

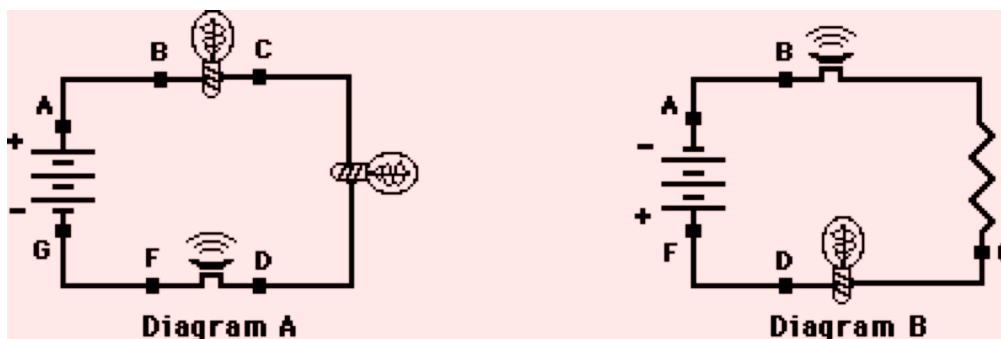
	Series Circuit	Parallel Circuit
a. <b>Definition:</b> The pathway by which charge loops around the circuit is characterized by _____ pathway(s).		
b. <b>Observation:</b> If one light bulb goes out, the other light bulbs _____.		
c. <b>Observation:</b> As the number of resistors is increased, the overall current _____.		
d. <b>Observation:</b> As the number of resistors is increased, the overall resistance _____.		

## Electric Circuits

4. The following diagrams represent circuits consisting of two electrical devices connected in series. For each diagram, fill in the blanks to show the voltage drop across the designated device.



5. Consider the following two diagrams of series circuits. For each diagram, use arrows to indicate the direction of the conventional current. Then, make comparisons of the voltage and the current at the designated points for each diagram.



$$V_A \text{ \_\_\_\_ } V_G$$

(>, <, or =)

$$V_B \text{ \_\_\_\_ } V_C$$

(>, <, or =)

$$V_B \text{ \_\_\_\_ } V_F$$

(>, <, or =)

$$I_A \text{ \_\_\_\_ } I_G$$

(>, <, or =)

$$V_A \text{ \_\_\_\_ } V_F$$

(>, <, or =)

$$V_B \text{ \_\_\_\_ } V_C$$

(>, <, or =)

$$V_D \text{ \_\_\_\_ } V_F$$

(>, <, or =)

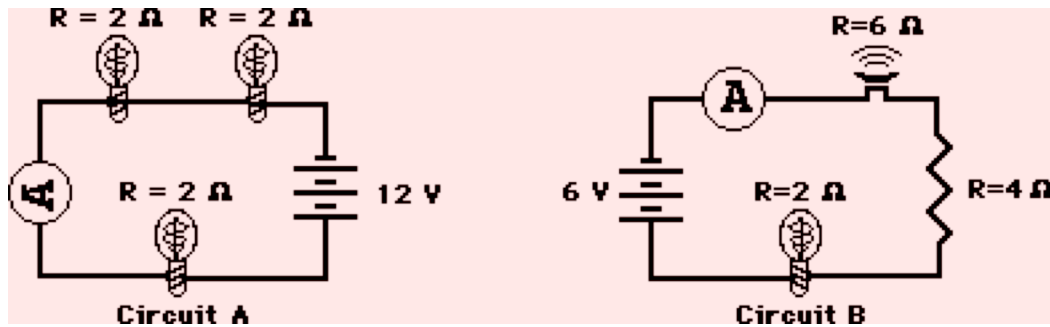
$$I_A \text{ \_\_\_\_ } I_F$$

(>, <, or =)

5. Express your understanding of equivalent resistance by filling in the blanks.
- Having two 4- $\Omega$  resistors in series is equivalent to having one \_\_\_\_- $\Omega$  resistor.
- Having three 4- $\Omega$  resistors in series is equivalent to having one \_\_\_\_- $\Omega$  resistor.
- Having four 4- $\Omega$  resistors in series is equivalent to having one \_\_\_\_- $\Omega$  resistor.
6. **TRUE** or **FALSE**:

Three light bulbs are connected in series. The filament of one of the light bulbs burns out. The remaining two light bulbs will still be lit; yet, their brightness will be noticeably less.

7. Analyze the following circuit and determine the equivalent or total resistance. Then determine the current at the ammeter location.



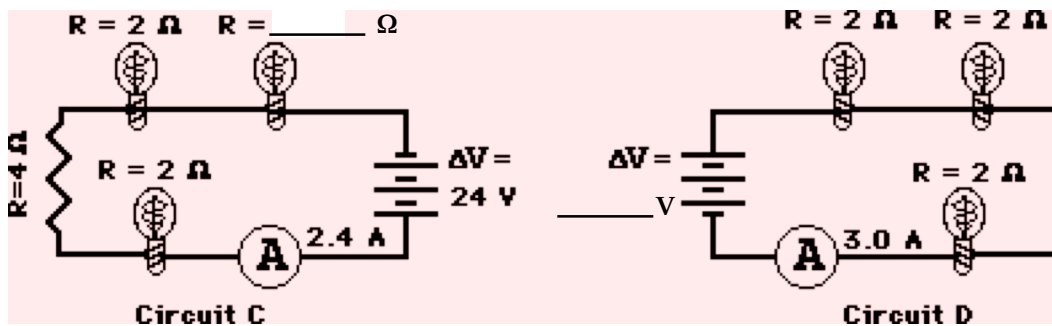
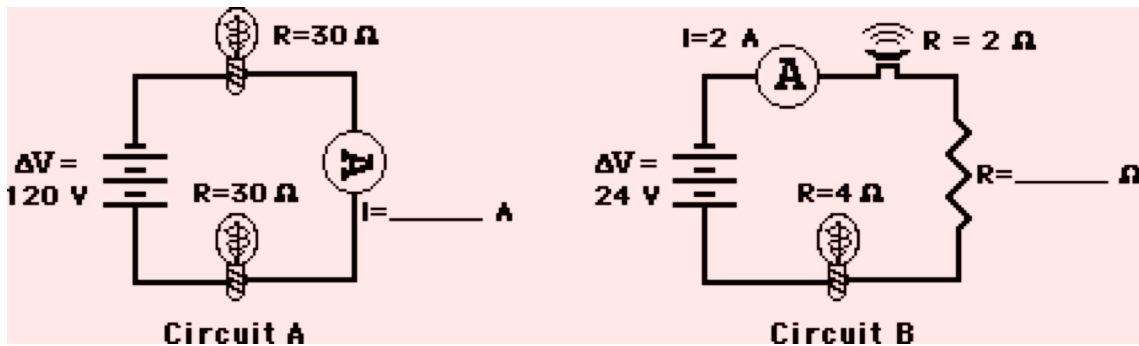
$R_{tot} =$  \_\_\_\_\_

$I =$  \_\_\_\_\_

$R_{tot} =$  \_\_\_\_\_

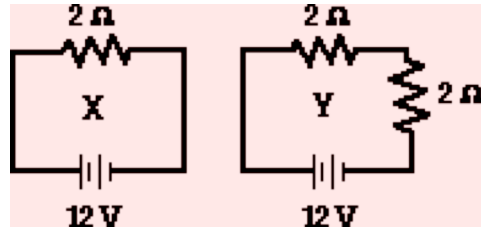
$I =$  \_\_\_\_\_

8. For the following diagrams, utilize the concept of equivalent resistance and Ohm's Law in order to fill in the blank.

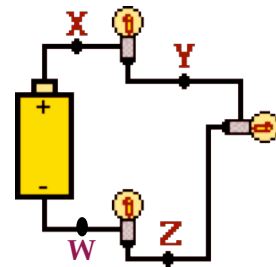


## Electric Circuits

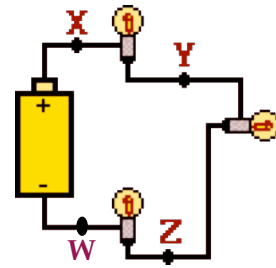
9. Compare circuits X and Y. Consider circuits X and Y below. Each circuit is powered by the same battery and contains identical resistors. Circuit X has one resistor and circuit Y has two resistors. The equivalent resistance of circuit X will be \_\_\_\_\_ ( $>$  or  $<$  or  $=$ ) that of circuit Y. The current in the battery in X will be \_\_\_\_\_ ( $>$  or  $<$  or  $=$ ) that in the battery in Y.



10. Three identical light bulbs are connected to a battery as shown below. Which adjustments could be made to the circuit that would increase the current being measured at X? Circle all that apply.
- Increase the resistance of one of the bulbs.
  - Decrease the resistance of two of the bulbs.
  - Increase the resistance of two of the bulbs.
  - Decrease the voltage of the battery.
  - Increase the voltage of the battery.
  - Remove one of the bulbs (and re-connect the circuit).

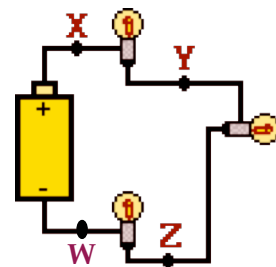


11. Three identical light bulbs are connected to a battery as shown below. W, X, Y and Z represent locations along the circuit. Which one of the following statements is true?
- The potential difference between X and Y is greater than that between Y and Z.
  - The potential difference between X and Y is greater than that between Y and W.
  - The potential difference between Y and Z is greater than that between Y and W.
  - The potential difference between X and Z is greater than that between Z and W.
  - The potential difference between X and W is greater than that across the battery.
  - The potential difference between X and Y is greater than that between Z and W.



12. Three identical light bulbs are connected to a battery as shown below. Which one of the following statements is true?
- All three bulbs will have the same brightness.
  - The bulb between X and Y will be the brightest.
  - The bulb between Y and Z will be the brightest.
  - The bulb between Z and the battery will be the brightest.

Justify your answer to this question using the language of physics.



13. Compare a circuit with three light bulbs to a circuit with two light bulbs. All light bulbs are identical. In which circuit will the overall power be the greatest? Intelligently defend your answer.