

Name: \_\_\_\_\_

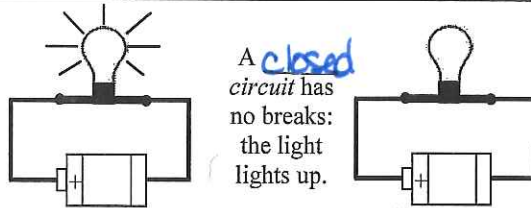
Period: \_\_\_\_\_

## Circuits and Symbols

Electricity works a lot like water. Often imagining how water would work in an circuit will tell you how electricity will work as well.

*e<sup>-</sup> travel*  
**Electricity flows through circuits: paths of wire (conductors)**  
 Any break in the circuit will cause the circuit to fail, just like a break in a pipe lets water leak out of a water system.

\* A break in a circuit is any spot where an insulator is in the way of the electricity's flow.  
plastics  
 even an air gap can keep electricity from flowing.



A closed circuit has no breaks: the light lights up.

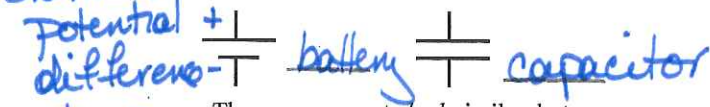
An open circuit has a break in it: the light will not light up.

*Drawbridge*

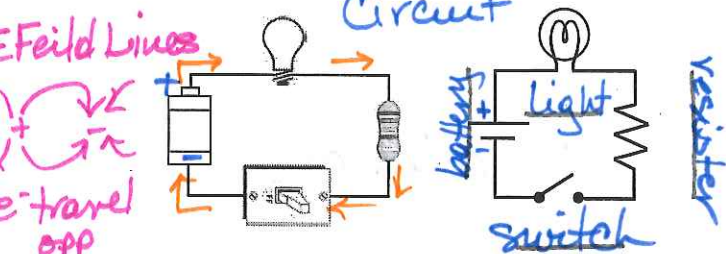
## Circuit diagrams

Electrical Symbols			
Electrical Device	Symbol	Function	Water Equivalents
wire	—	path for e <sup>-</sup> to flow = elect.	pipe
battery	$\begin{matrix} + \\   \\ - \end{matrix}$	supply of e <sup>-</sup> chem pot dif "pushes" elect.	H <sub>2</sub> O Pump
light bulb		lights up slow e <sup>-</sup> flow resisting elect	none
switch		allows e <sup>-</sup> to travel controls on/off electricity	faucet valve dam
resistor		slows flow resist flow electricity	diameter pipe

2 or more cells  
 Chemical Potential difference  
 + -



These components look similar, but are very different and have different functions.



The diagram on the right is a faster way of drawing the circuit on the left. (Notice the + of the battery, which is important)

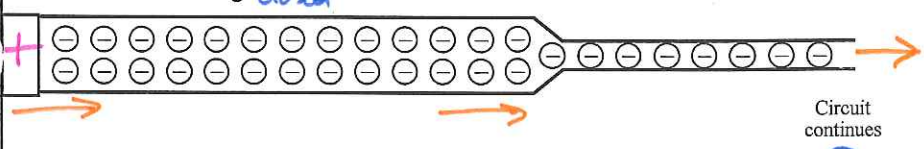
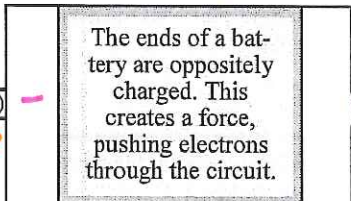
*EField Lines*  
 e<sup>-</sup> travel opp  
 Potential Difference + -  
 e<sup>-</sup> flow - to +  
 convention draw + to -  
 (V) Voltage "push" of elec

### 3 Quantities of a Circuit

(I) Current "flows elect" through circuit  
 The flow of e<sup>-</sup> we call current which travels through closed circuits.

Resistance resist current  
 Devices in the circuit do work, which resist current.

*H<sub>2</sub>O analogy*  
 V  
 Voltage is measured in volts  
 height H<sub>2</sub>O fall  
 higher = greater potential



I  
 Current is measured in Amps  
 speed of current

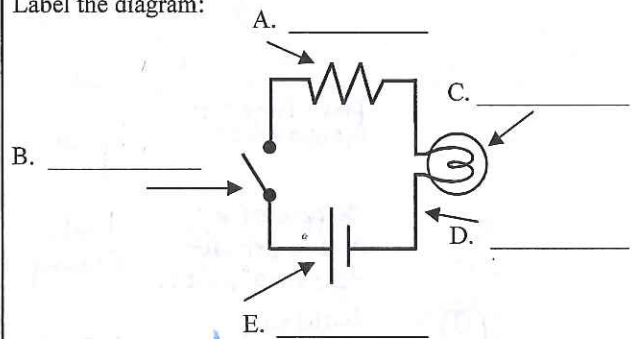
R  
 Resistance is measured in ohm  
 diameter of pipe

These three quantities are linked in any circuit. Change one of them and one or both of the others will change.

difficulty e<sup>-</sup> to flow  
 ↑ R = harder for e<sup>-</sup> to travel  
 (R)

Name: \_\_\_\_\_

Period: \_\_\_\_\_

<ol style="list-style-type: none"> <li>1. Open circuit</li> <li>2. Closed circuit</li> <li>3. Circuit diagram</li> <li>4. Voltage</li> <li>5. Current</li> <li>6. Resistance</li> </ol>	<ol style="list-style-type: none"> <li>A. Slows down the flow of electricity.</li> <li>B. A short-hand way of drawing electrical circuits.</li> <li>C. A circuit with a break in it; no electricity will flow.</li> <li>D. Pushes electricity through a circuit.</li> <li>E. Electricity can flow through this.</li> <li>F. The flow of electricity through a circuit.</li> </ol>	<p>Match the electrical component with the water component and diagram symbol</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%; vertical-align: top;"> <ol style="list-style-type: none"> <li>1. Valve</li> <li>2. Pipes</li> <li>3. No equivalent</li> <li>4. Resists flow</li> <li>5. Pump</li> </ol> </td> <td style="width: 25%; vertical-align: top;"> <ol style="list-style-type: none"> <li>A. Resistor</li> <li>B. Battery</li> <li>C. Switch</li> <li>D. Wire</li> <li>E. Light bulb</li> </ol> </td> <td style="width: 25%; vertical-align: top;"> <ol style="list-style-type: none"> <li>a. </li> <li>b. </li> <li>c. </li> <li>d. </li> <li>e. </li> </ol> </td> <td style="width: 25%;"></td> </tr> </table>		<ol style="list-style-type: none"> <li>1. Valve</li> <li>2. Pipes</li> <li>3. No equivalent</li> <li>4. Resists flow</li> <li>5. Pump</li> </ol>	<ol style="list-style-type: none"> <li>A. Resistor</li> <li>B. Battery</li> <li>C. Switch</li> <li>D. Wire</li> <li>E. Light bulb</li> </ol>	<ol style="list-style-type: none"> <li>a. </li> <li>b. </li> <li>c. </li> <li>d. </li> <li>e. </li> </ol>	
<ol style="list-style-type: none"> <li>1. Valve</li> <li>2. Pipes</li> <li>3. No equivalent</li> <li>4. Resists flow</li> <li>5. Pump</li> </ol>	<ol style="list-style-type: none"> <li>A. Resistor</li> <li>B. Battery</li> <li>C. Switch</li> <li>D. Wire</li> <li>E. Light bulb</li> </ol>	<ol style="list-style-type: none"> <li>a. </li> <li>b. </li> <li>c. </li> <li>d. </li> <li>e. </li> </ol>					
<p>Which of the following are correct?</p> <p>A.  B.  C.  D. </p>		<ol style="list-style-type: none"> <li>1. Wires</li> <li>2. Battery</li> <li>3. Resistor</li> <li>4. Light bulb</li> <li>5. Switch</li> </ol> <ol style="list-style-type: none"> <li>A. Used to create radiant energy.</li> <li>B. Pushes electricity through the circuit.</li> <li>C. Can turn the electricity on and off.</li> <li>D. Allows electricity to flow.</li> <li>E. Slows down the flow of electricity.</li> </ol>					
<p>Label the diagram:</p> 		<p>Draw a circuit diagram (starting on the left) with a battery, a resistor, a lightbulb, and a switch. Make sure it is a closed circuit, connected with wires.</p>					

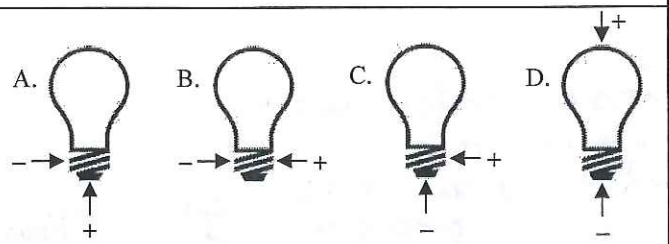
In the Lab

Prediction

Start by making a circuit with a battery, light bulb, and switch. Turn on the switch to be sure the circuit is correct (light comes on). Next connect an alligator clip wire to either side of the switch. Touch the free ends of the alligator clip wires together to be sure the light still turns on. If not find the problem. When correct, use the free ends as probes to complete the following task.

Using the electrical circuit above, test which of these are conductors (C) or insulators (I)		
Paper _____	Paperclip _____	Cloth _____
Lock Nut _____	Glass _____	Wood _____
Penny _____	Plastic _____	Rubber _____

Connect alligator clip wires to either side of the battery. Take a light bulb out of the holder. Circle the letter of the following diagrams that light up the light bulb.



Where are the two parts of a light bulb that must be touched complete the light bulb circuit?

Create in the lab and draw the diagram for the following circuit: battery; light bulb; switch; complete the circuit (close the circuit). What happens if you reverse (turn around) the battery? (You must reverse the whole battery holder.)