

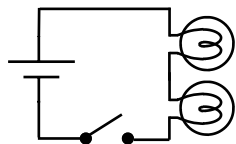
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Ch.7:1

## Types of Circuits and Ohm's Law

Series circuits have all only one path for the electricity to flow.



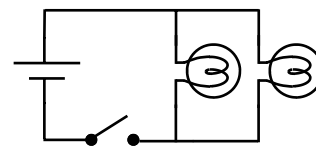
*Two lightbulbs in series.  
Each light is dependent  
on the other.*

If any part of a series circuit is broken, the circuit fails. If either light is unscrewed both lights will turn off.

### Types of Circuits

The branches (paths) of a parallel circuit are independent. If either light is unscrewed, the other will remain on.

Parallel circuits have multiple paths for the electricity to flow.



*Two lightbulbs in parallel.  
Each light is independent  
of each other.*

*Your house is wired in parallel, so that each light and appliance can be turned on and off independently.*

### Ohm's Law

$$\text{Current (in amps)} \rightarrow I = \frac{V}{R}$$

Voltage  
(in volts)  $\swarrow$

$\nwarrow$  Resistance  
(in ohms)

*Current equals the voltage  
divided by the resistance.*

Also,  $V = IR$  and  $R = V/I$

#### Abbreviations:

**A - Amps - current**

**v - volts - voltage**

**$\Omega$  - ohms - resistance**

**Increasing voltage  
increases current.**

**Increasing resistance  
decreases current.**

**Decreasing voltage  
decreases current.**

**Decreasing resistance  
increases current.**

*Ex. How much current does a 12 v  
battery push through a  $3\Omega$  resistor?*

$$\begin{aligned} V &= 12 \text{ v} \\ R &= 3 \Omega \\ I &= ? \end{aligned}$$

$$I = \frac{V}{R} = \frac{12 \text{ v}}{3 \Omega} = 4 \text{ A}$$

*Ex. How strong a battery produces  
2 A through a  $3\Omega$  resistor?*

$$\begin{aligned} V &= ? \text{ v} \\ R &= 3 \Omega \\ I &= 2 \text{ A} \end{aligned}$$

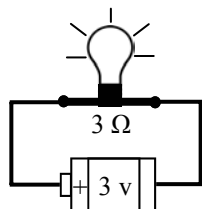
$$\begin{aligned} I &= \frac{V}{R} & \text{So, } V &= IR \\ & & &= (2 \text{ A})(3 \Omega) \\ & & &= 6 \text{ v} \end{aligned}$$

### Current

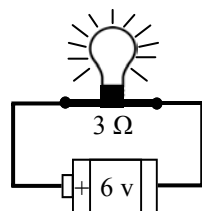
Current is moving electrons,  
moving charge.

Increasing current causes  
more electricity to move  
through a device.

Increasing electricity through  
a device causes it to work  
faster (in a motor) or be  
brighter (in a lightbulb).



Using Ohm's  
Law:  $I = V/R$   
 $I = 3\text{v}/3\Omega$   
 $I = 1 \text{ A}$



Using Ohm's  
Law:  $I = V/R$   
 $I = 6\text{v}/3\Omega$   
 $I = 2 \text{ A}$

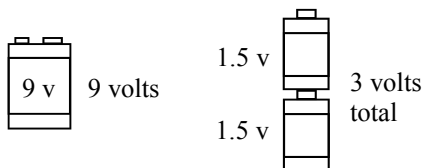
**More current =  
brighter light.**

### Voltage

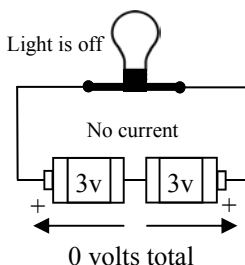
Voltage is electrical potential:  
how much work a battery can do.

Voltage is linked to energy:  
**1 volt of voltage = 1 joule of energy  
per coulomb of charge**

To increase voltage you could use a  
stronger battery OR add batteries.



**More voltage is like a  
stronger pump, giving more  
force and more current.**

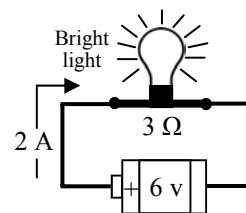


The lightbulb doesn't  
light here, because  
the two batteries are  
pushing *opposite*  
*directions*. To add  
together, batteries  
must be facing the  
same direction.

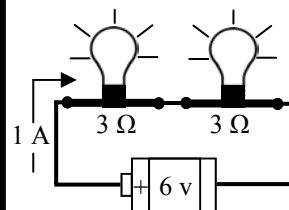
### Resistance

Resistance slows down current.  
Think of resistance like  
a dam holding back water.

Adding devices in a circuit  
increases resistance.



$I = V/R$   
 $= 6\text{v}/3\Omega = 2 \text{ A}$   
The light is bright  
because the 6  
volts only have  
one light to run.

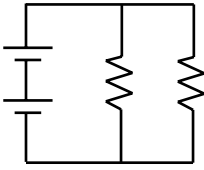
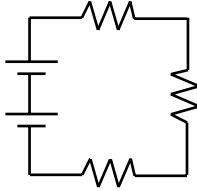
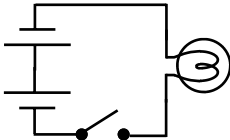
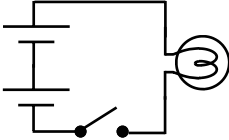


$I = V/R$   
 $= 6\text{v}/6\Omega = 1 \text{ A}$   
Both lights are  
dimmer because  
the 6 volts have  
two lights to run.

**More resistance = less current  
Less current = less light**

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

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

1. I = _____ 2. V = _____ 3. R = _____ 4. E = _____ 5. P = _____ 6. F = _____	4 newtons 4 amps 4 joules 4 watts 4 ohms ( $\Omega$ ) 4 volts	Label the diagrams as parallel or series circuits. <div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>A. _____</p> </div> <div style="text-align: center;">  <p>B. _____</p> </div> </div>
The units for current is _____; the abbreviation is _____. The units of voltage is _____; the abbreviation is _____. The units of resistance is _____; the abbreviation is _____.		<div style="text-align: center; border: 1px solid black; padding: 2px; margin-bottom: 5px;"> <b>Series or Parallel Circuits?</b> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>_____ Only one path for the electricity.</p> <p>_____ Dependent paths.</p> <p>_____ How your house is wired.</p> <p>_____ Independent current paths.</p> </div> <div style="width: 45%;"> <p>_____ Can turn off one light without others turning off.</p> <p>_____ If you turn off one light, all the lights turn off.</p> <p>_____ More than one path for the electricity to flow.</p> </div> </div>
If you increase voltage, the current will increase or decrease? If you decrease resistance, the current will increase or decrease? If the current increases, the resistance increased or decreased? If voltage is decreased, the current will increase or decrease? If the current decreases, the voltage increased or decreased? If there is more current will a light bulb be brighter or dimmer?		How much current goes through a circuit with a 12 v battery and a 3 $\Omega$ resistor?  Find the current in circuit with 6 v battery and 2 resistor:
Will the lights turn on or not? And why? <div style="display: flex; justify-content: space-around; align-items: center;">   </div>		How much voltage gives 5 amps of current through a 3 $\Omega$ light bulb?

**In the Lab**

Circuit 1: battery; light bulb; switch. Draw diagram:       What happens if you unscrew the light bulb?	Circuit 3: 2 batteries; light bulb; switch. Draw diagram:       How does the light's brightness compare to circuit 1 and why?
Circuit 2: battery; 2 light bulbs; switch. Draw diagram:       How does the light's brightness compare to circuit 1 and why?	Circuit 4: 2 batteries; 2 light bulbs; switch. Draw diagram:       What happens if you unscrew a light bulb? Is this a series or parallel circuit?