ELECTRICITY


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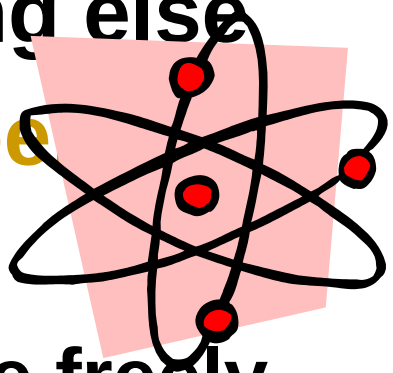
REVIEW ATOM PARTS AND CHARGES

- **<u>Electrons</u> are negatively charged particles that can be transferred to something else**
- **<u>Law of Attraction:</u> Like charges repe opposites attract**
  - **<u>Insulators:</u> e-'s are not able to move freely (plastic)**
  - **<u>Conductors:</u> electrons are able to move freely (metals)**

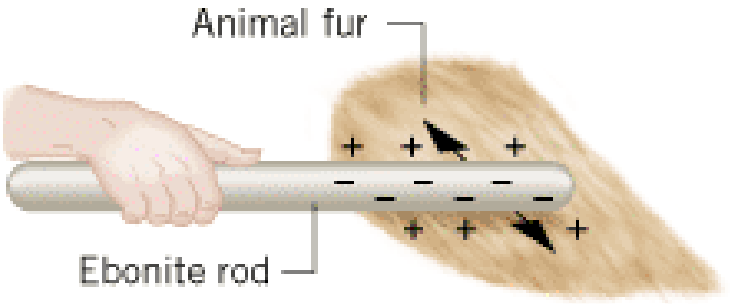


STATIC CHARGE – THE BUILD UP OF POSITIVE OR NEGATIVE CHARGES IN AN OBJECT.

- CHARGE IS MEASURED IN COULOMBS (C)
- HOW DOES SOMETHING BECOME CHARGED???.....

1. FRICTION: RUBBING ONE OBJECT AGAINST ANOTHER CAN MOVE ELECTRONS LEAVING BOTH CHARGED

One will lose electrons, and one will gain



2. CONDUCTION: ELECTRONS TRANSFERRED BY TOUCHING

Example:

Shaking hands and getting shocked!

3. INDUCTION:

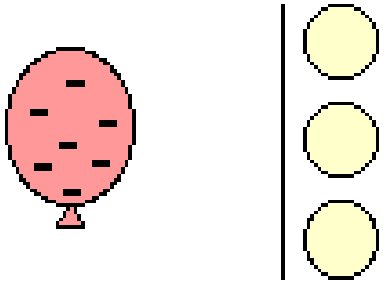
BRINGING A CHARGED OBJECT NEAR A NEUTRAL OBJECT.

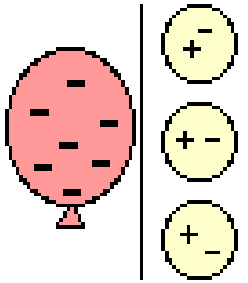
- NEUTRAL OBJECT WILL HAVE A CHARGE OPPOSITE OF THE ORIGINAL CHARGED OBJECT.

- CHARGED OBJECT WILL ATTRACT UNLIKE CHARGE AND REPEL LIKE CHARGE IN THE NEUTRAL OBJECT

BALLOONS AND STATIC CHARGE

- **Objects can be charged by the transfer of electrons. If you rub a balloon across your hair on a dry day, the balloon and your hair become charged and are attracted toward each other.**





TERMS FOR ELECTRICITY

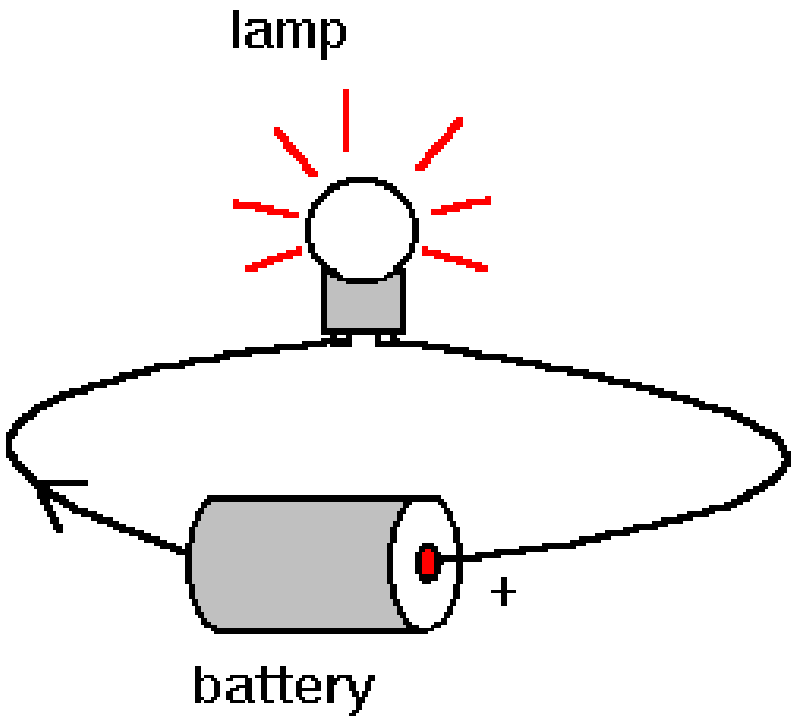
1. **Voltage (V): measure of potential energy of an electric field & provides energy that pushes & pulls electrons through a circuit**
   - **measured in volts (v)**
2. **Electric current (I): flow of electrons through a conductor (wire, etc)**
   - **Measured in amps (A), symbol is I**
3. **Resistance (R): when electrons in a wire run into things and bounce around**
   - **opposes the flow of electrons (light bulb, electrical devices)**
   - **measured in ohms (omega - Ω)**

VOLTAGE AND ELECTRIC CURRENT EXAMPLE: A BATTERY

- **One terminal has extra electrons & the other has less electrons**

  (- and +)

- **Electrons are pushed by negative terminal and pulled by positive terminal.**



1. You put on your sweater and notice your hair is standing straight up… why?

2. Which is a good insulator?

a. plastic spoon b. silver spoon c. copper wire d. silver wire

3. What is lightning and why does it occur?

4. What happens when two materials are charged by rubbing against each other?

a. both lose electrons

b. both gain electrons

c. 1 loses & 1 gains e-'s

d. no movement of e-'s

“POWERMAT” WIRELESS CHARGER

- **The technology behind PowerMat is known as 'electromagnetic <u>induction</u>'**
- **When a PowerMat is charging it is generating rapidly changing magnetic fields above the mat; these are converted by receivers on any devices on the mat into electrical power, and so these devices get charged.**
- **The magnetic fields and electrical currents are, of course, very small and so they can work on handheld gadgets without being a health risk to humans.**

The same technology is used in a huge number of other devices including generators, motors, transformers, some cookers, induct... example is in rechargeable electric... into a 'dock' daily to keep it charged.

PowerMat is currently the best known example of a wireless charger but this technology is developing rapidly. The PowerMat company itself is planning to extend the technology and feature it in kitchen counters, walls, and other surfaces around the home. Finally we will be freed of the endless tangle of chargers and wires around the home.

WHEN A CURRENT MEETS RESISTANCE…

- **Heat is produced**
- **Large diameter wires have less resistance**
- **Longer (in length) wires have greater resistance**
- **Higher temperature = greater**

RESISTANCE IN WIRES LAB

Observations:

1. **“Simple circuit” (just short black alligator wires):**
2. **“Simple circuit” (short black and longer red alligator wires) brightness:**
3. **Long thin silver wire brightness:**

Questions:

1. **What is the general relationship between amount of resistance in a circuit and brightness of a lightbulb?**
2. **How did the length of the thin wire affect the brightness of the lightbulb?**
3. **What are the 2 physical dimensions that affect**

MYTHBUSTERS & ELECTRICITY QUESTIONS

1. **Was the cell phone on airplane myth busted, plausible, or confirmed and why?**

2. **Was the myth about being zapped by lightening while in the shower or on the phone busted, plausible or confirmed, and why?**

3. **Did this video get you all charged up?**

THURSDAY 12/3 - BELLRINGER

1. Which is a requirement for work to be done?

a. force is exerted ***b. object is carried***

c. force moves an object ***d. a machine is used***

2. In which case is work being done?

a. pushing a lawn mower ***b. listening to music***

c. leaning against a wall ***d.cup sitting on table***

3. What happens to an electric current when it flows through an object with resistance?

a. some electric energy converts to thermal energy

b. some electric energy converts mechanical energy

c. the object melts ***d. the current increases***

RESISTANCE CAN BE CALCULATED FROM CURRENT AND VOLTAGE.

Ohm's Law: describes relationship between voltage, current and resistance

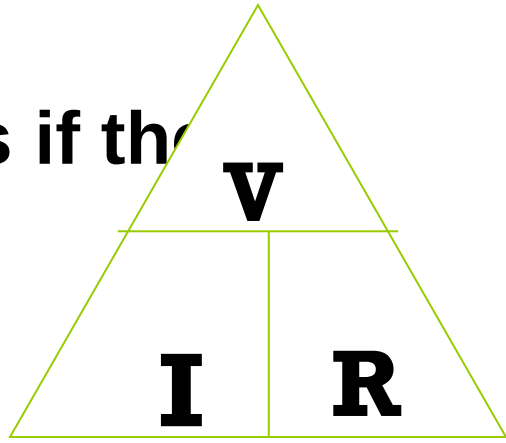
Formula: $V = I \cdot R$

Measurement	Symbol	Unit
Resistance	R	Ohm- Ω
Voltage	V	Volt- V
Current	I	Amp- A

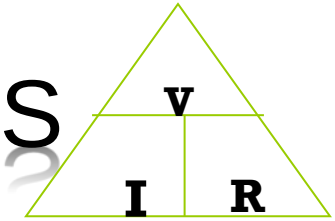
- **Practice Problem #1:**

The headlights of a car are powered by a 12 V battery.

What is the resistance of the headlights if the draw 3.0 A of current when turned on?



OHM'S LAW PRACTICE PROBLEMS



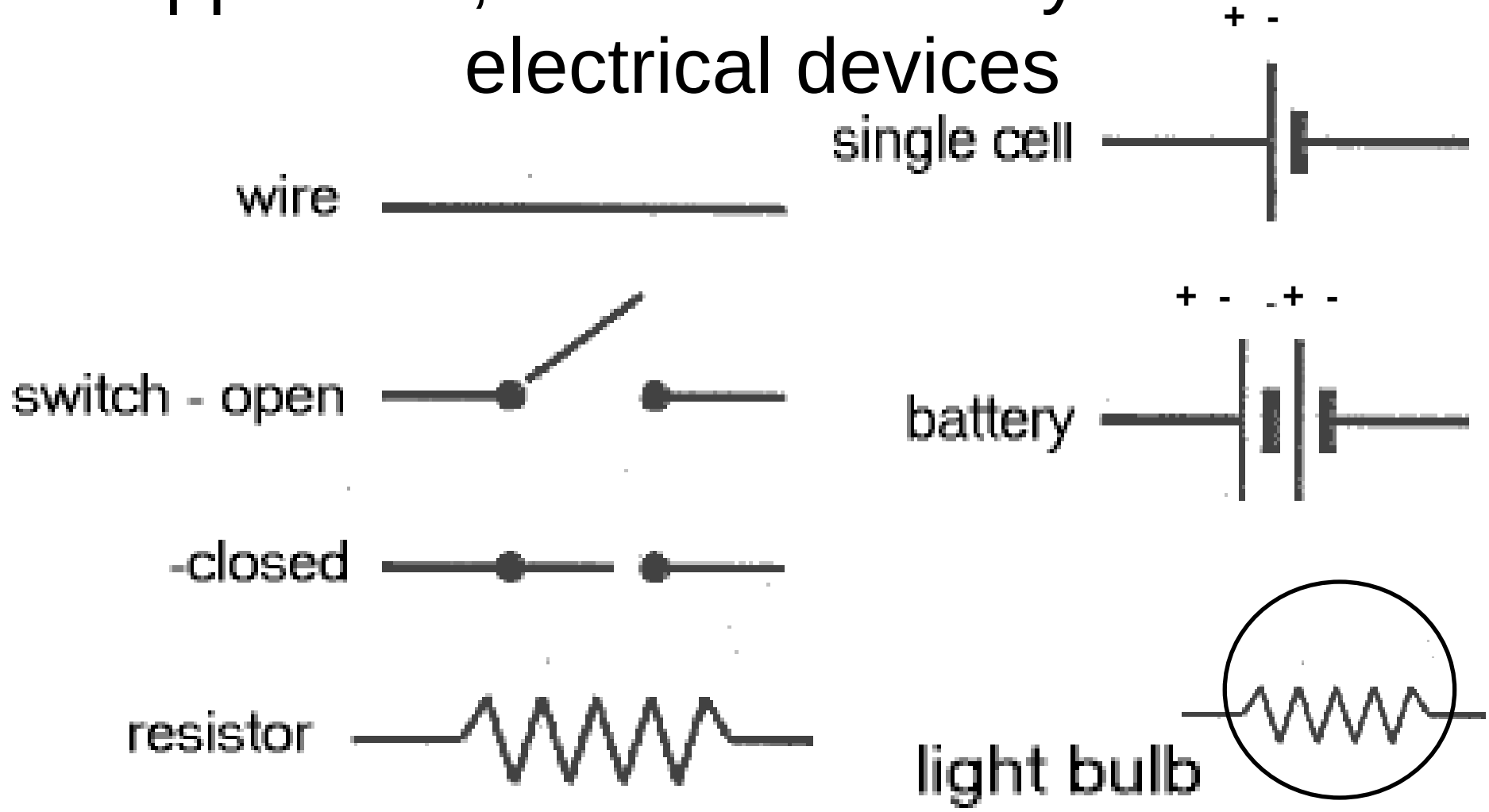
1. What is the voltage if the current is 0.5 A and resistance is 0.8 ohm?

2. What is the current of a circuit that has 3 V and 0.5 ohm of resistance?

3. What is the resistance if voltage is 3.0 V and current is 1.5 A?

ELECTRICITY SYMBOLS

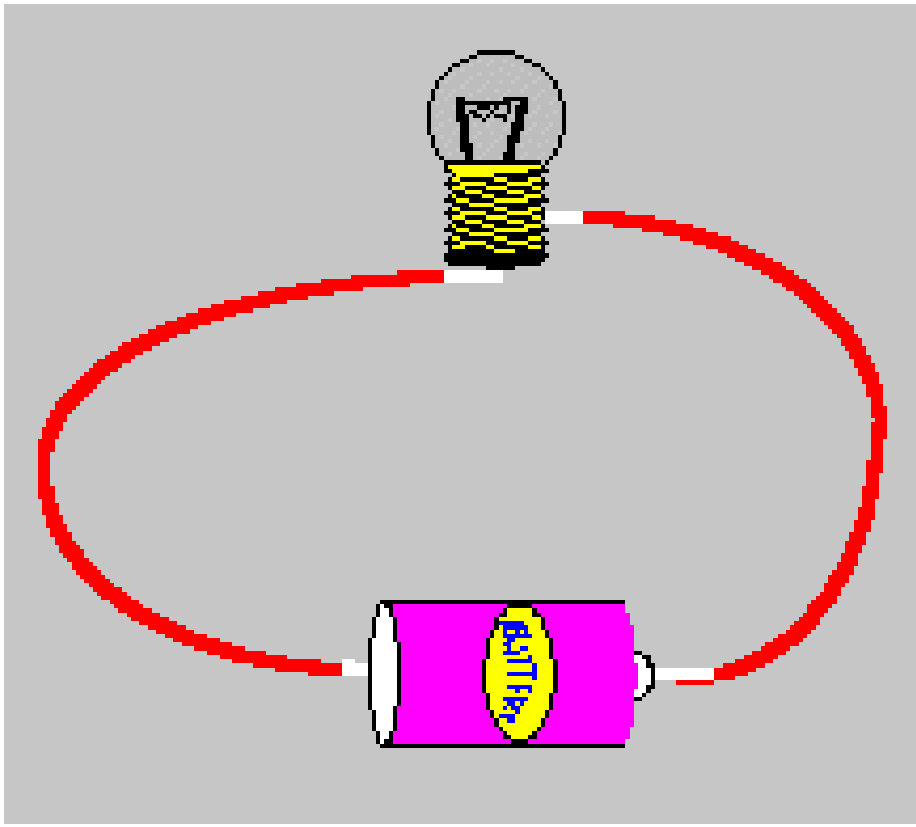
Schematic diagrams – a graphic representation of an electric circuit or apparatus, with standard symbols for electrical devices



An electric circuit is a path through which charges can be conducted.

- **<u>Closed Circuit:</u> a closed-loop path where current flows**

- **<u>Open Circuit:</u> no complete path, no charge flow and therefore no current**



ELECTRICAL CIRCUITS AND CURRENT FLOW

THERE ARE TWO DIFFERENT TYPES OF CIRCUITS…

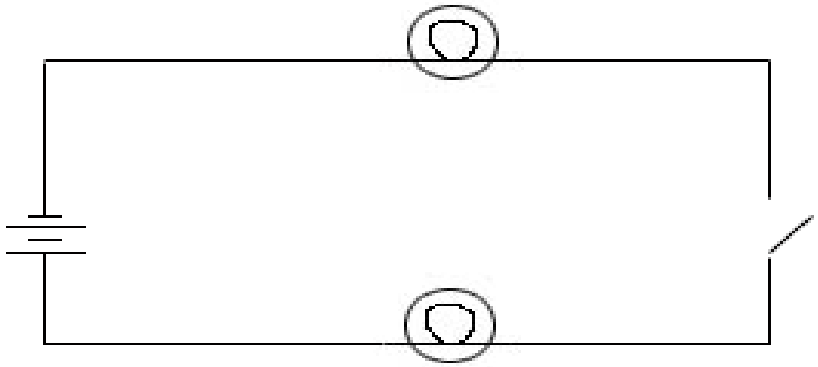
1. SERIES CIRCUITS

- **There is a <u>single path</u> for electrons**

<u>Important Facto</u>

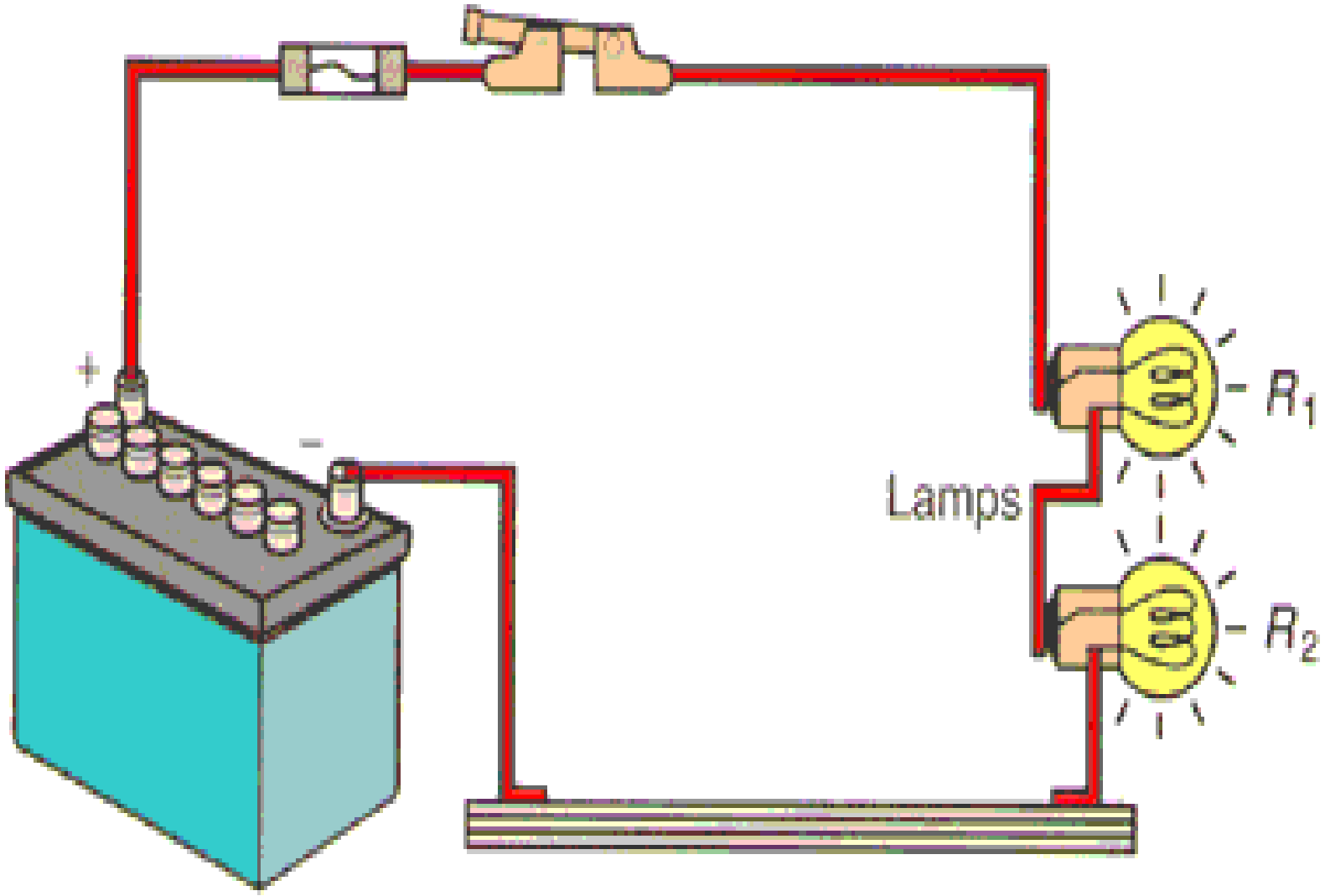
- **If additional**
  series, then
  increase and

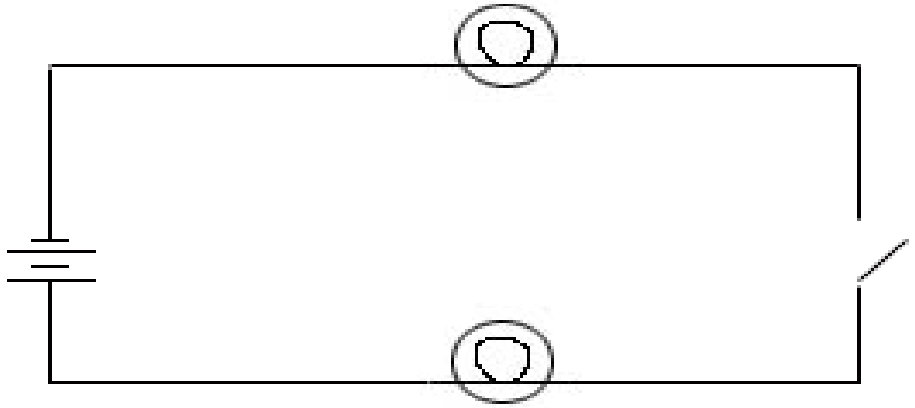
  [Ex: placing
  into a circuit
  causes the l



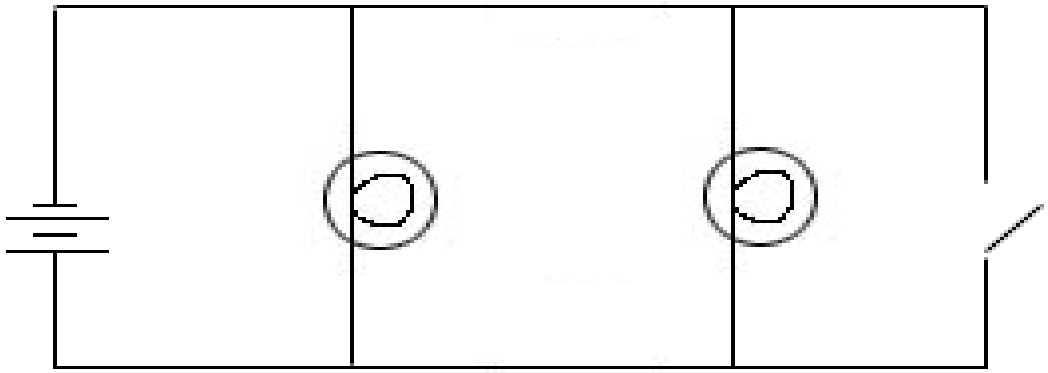
series circuit

- **If 1 bulb burns out or is removed, the circuit is “opened” and current cannot flow**
- **Batteries in series increase the voltag**

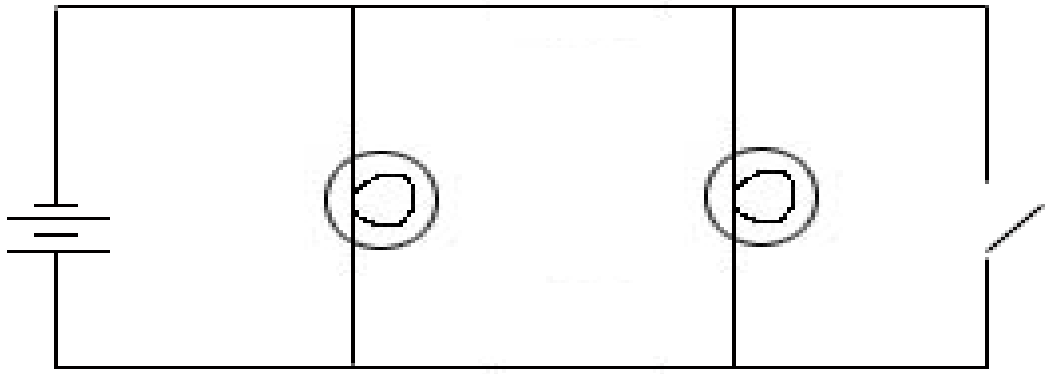

+
−
Lamps
R_1
R_2

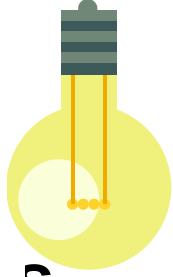


series circuit



parallel circuit





- T
  c

s

parallel circuit

Impo

- V
  c
- **If additional resistors are wired into the circuit, then resistance is reduced**
- **If another path is added to the circuit, then the total current will increase**
- **If bulb is removed or burns out it DOES NOT affect the rest of the bulbs**
- **Batteries wired in parallel do not change the voltage but make batteries last longer**

Now, answer these questions!

This your ticket to ….

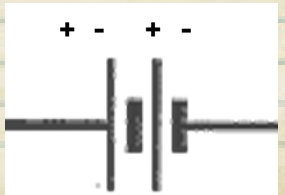
1. **How many loops are in a series circuit?**
2. **Identify two ways to <u>increase the current</u> in a simple circuit.**
3. **A current of 0.5 A flows in a 60W lightbulb when the voltage between the ends of the filament is 120 V. What is the resistance of the filament?**
4. **How does the voltage compare in each branch of a parallel circuit?**

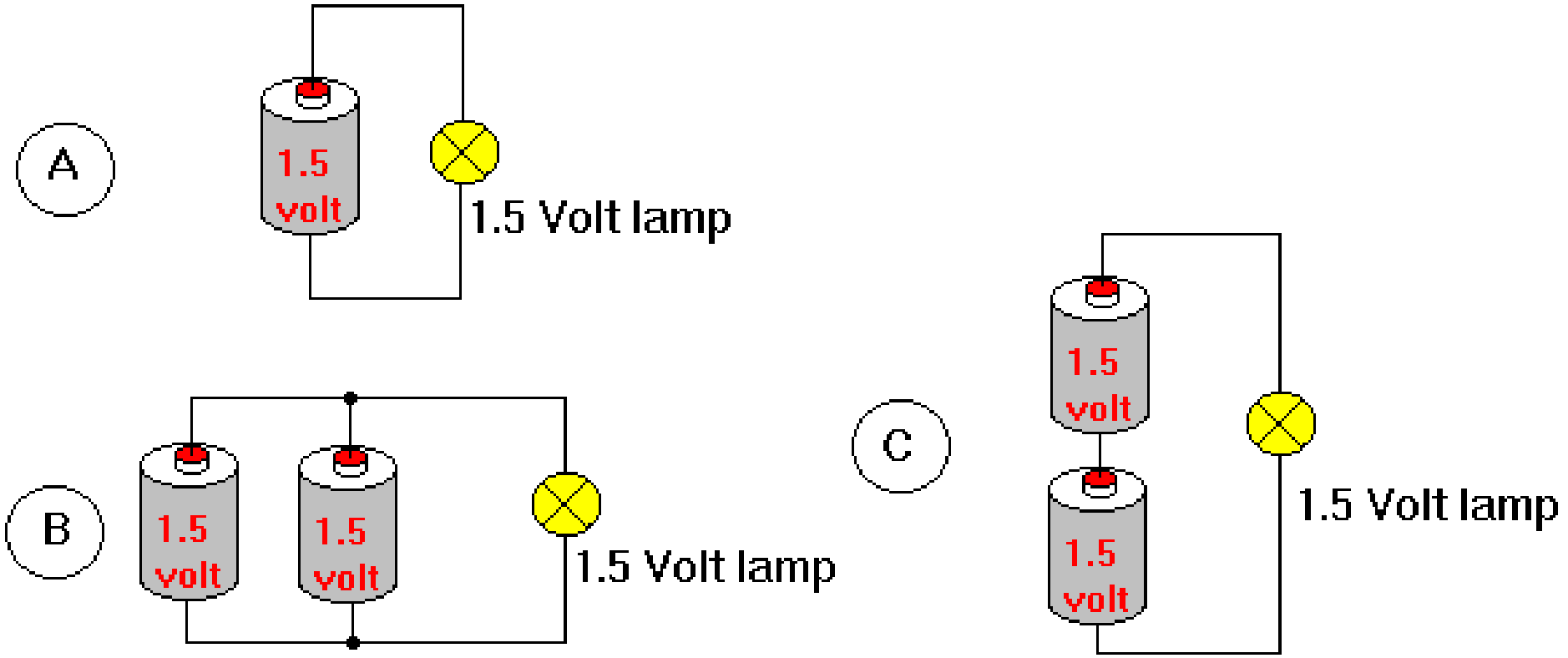
FRIDAY 12/4 - BELLRINGER

1. What is the formula V=IR called?
2. What is the effect on current if both V and R are reduced by half?

3. A circuit has a resistance of 15 Ω and a current of 0.6 A. What is the voltage?

4. Which type of circuit contains more than one branch for the current to move through?
5. What happens to the resistance and current when a new bulb is added to a series circuit?
6. What does this symbol represent?





A. This is a series circuit and the bulb will be normal brightness.

B. The batteries are in parallel & will give 1.5 volts. The lamps will be normal brightness, but batteries will last twice as long.

C. The batteries are in series and give 3 volts. The lamp will be very bright, but will blow out quickly.

THE TWO TYPES OF CURRENT

- Current: measures electron flow through a conductor (wire).

1. Direct current (DC)

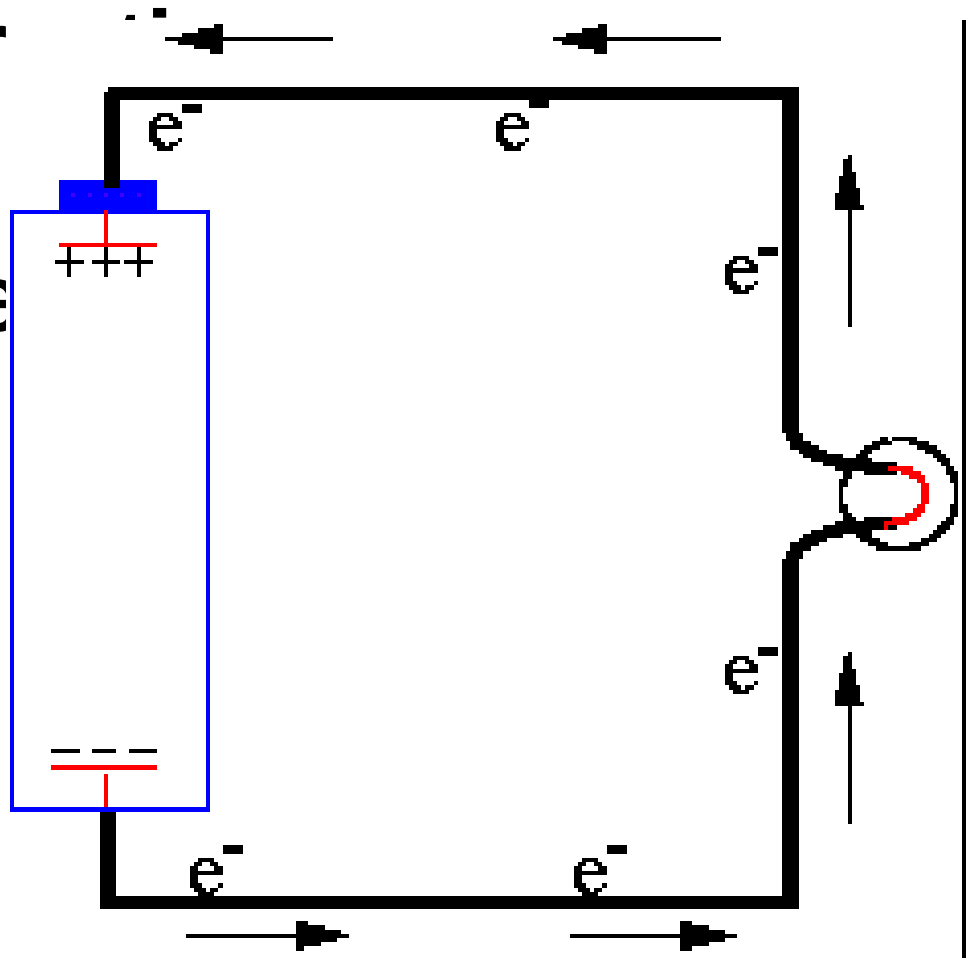
flows only in one dir

- **Batteries produce**

DC currents

- **used for short**

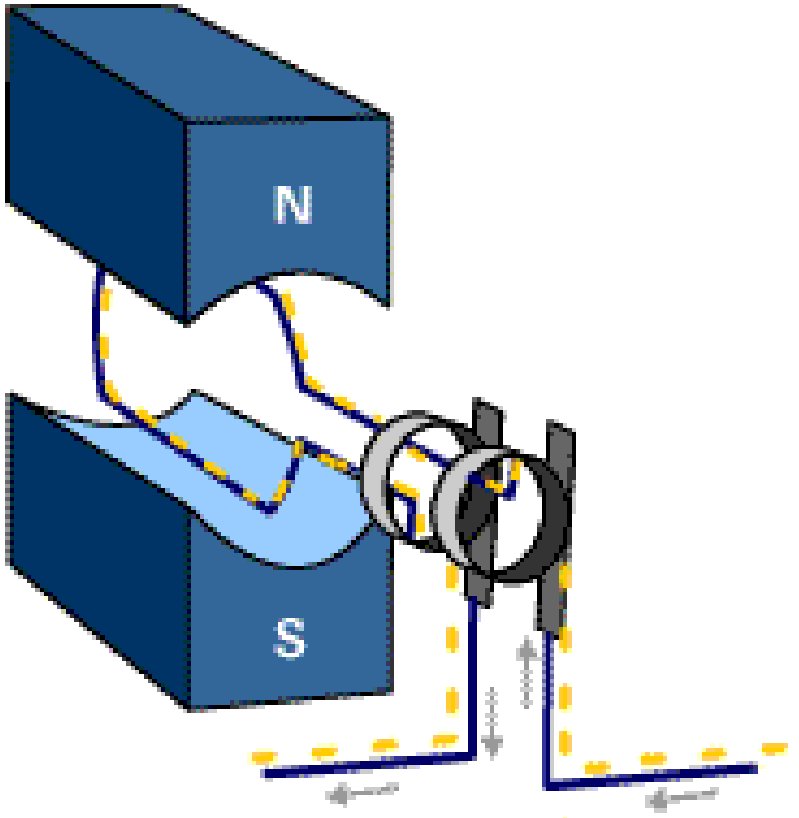
distances



THE TWO TYPES OF CURRENT

2. <u>Alternating current</u> (AC) electrons are pulled back and forth as the terminals alternate between + and -

- as the electrons "chase" the AC, the terminal continually changes from pos. to neg.

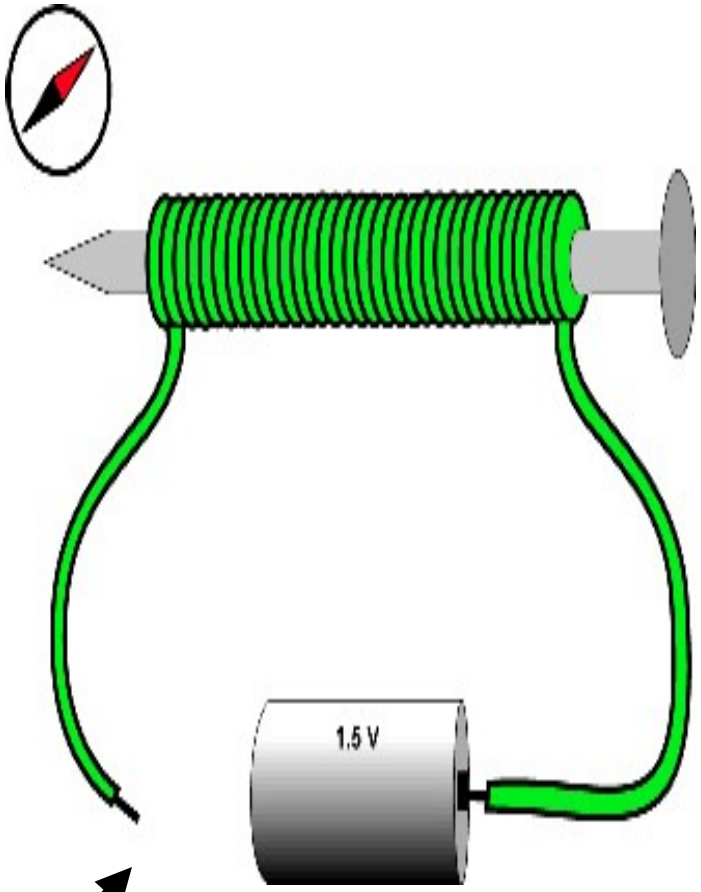


- found in electric lines that extend over long distances

Electromagnet – electric currents in wires produce magnetic fields around the wire

How to strengthen the magnetic field:

- ↑ number of loops of wire
- ↑ amount of current in the wire
- adding a core made of iron through the center of the coil
  - Magnetic field of wire produces magnetic field on nail

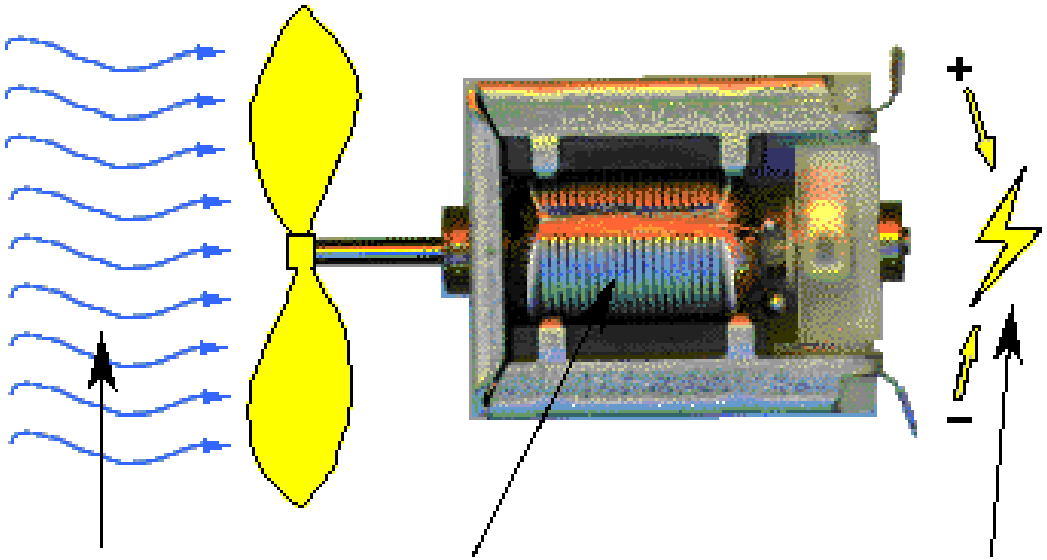


electromagnet

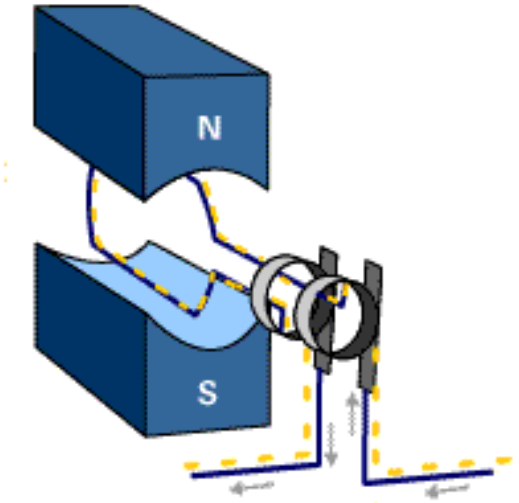
Generator – Converts mechanical energy into electricity & creates an alternating current

- For each half rotation the current reverses direction = Alternating current (AC)
- Almost all of the electrical energy we use in our daily lives is supplied by electric generators

Generator produces electricity



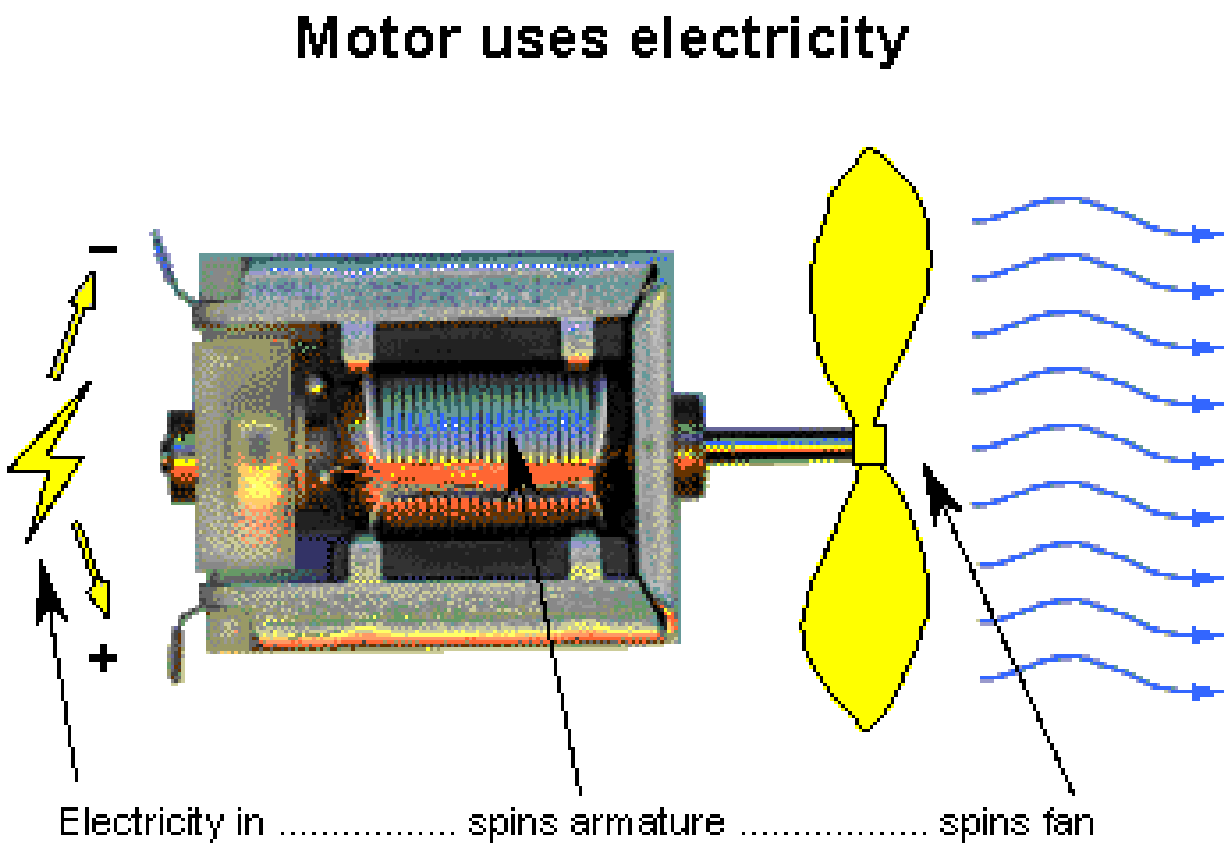
Wind ..... spins armature ..... produces electricity

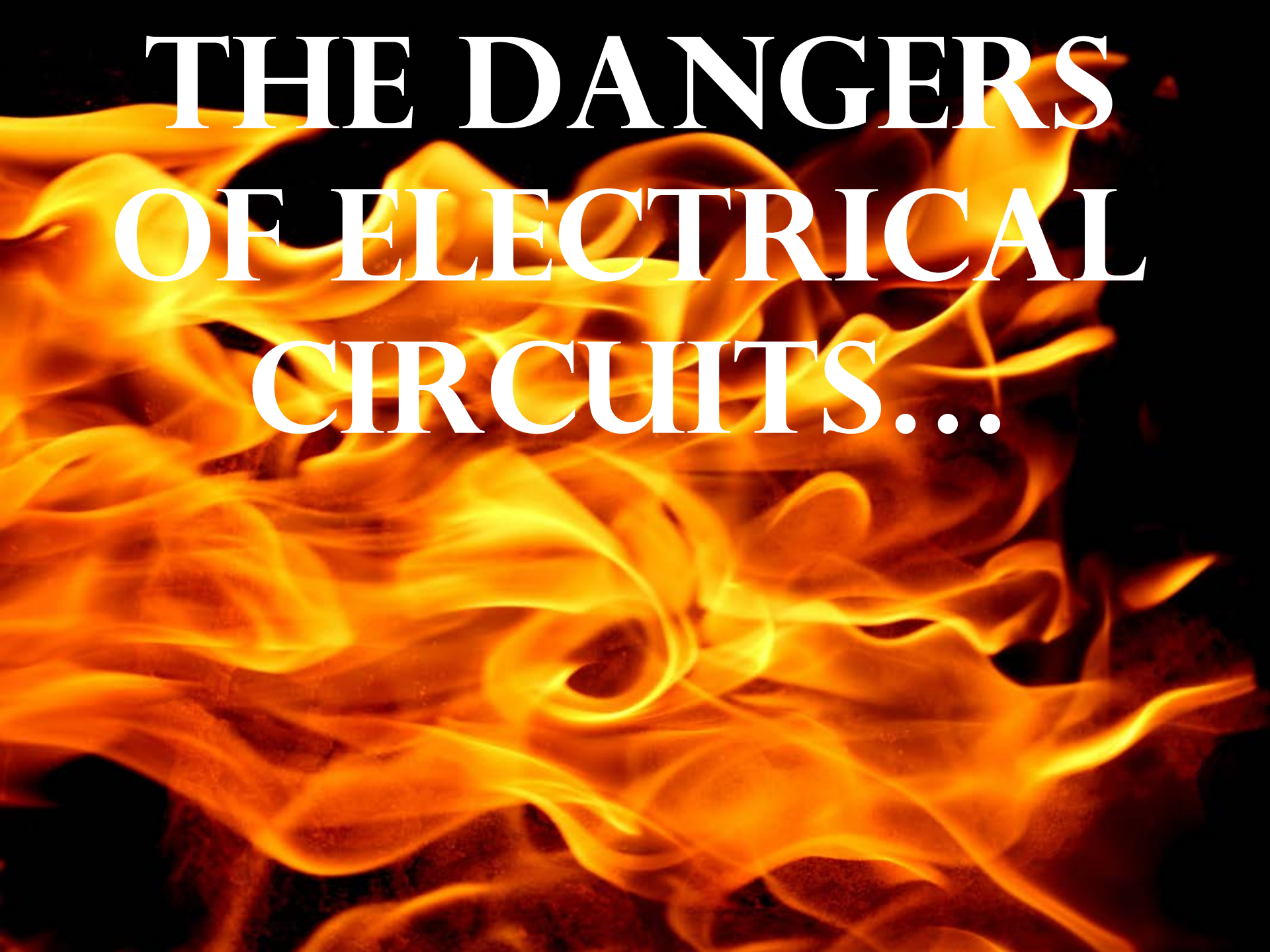


Motor – Converts electricity into **mechanical energy** to make things move

- utilizes **electromagnetic induction** to produce motion

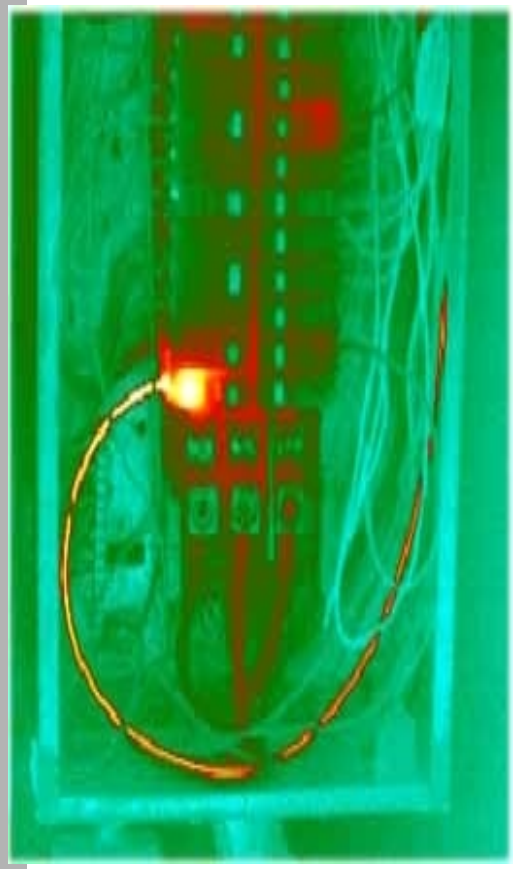
- The conductor (coiled wire) will move to oppose the **magnetic field -** current is reversed, and the coil spins round and round like a dog chasing its tail




THE DANGERS
OF ELECTRICAL
CIRCUITS…

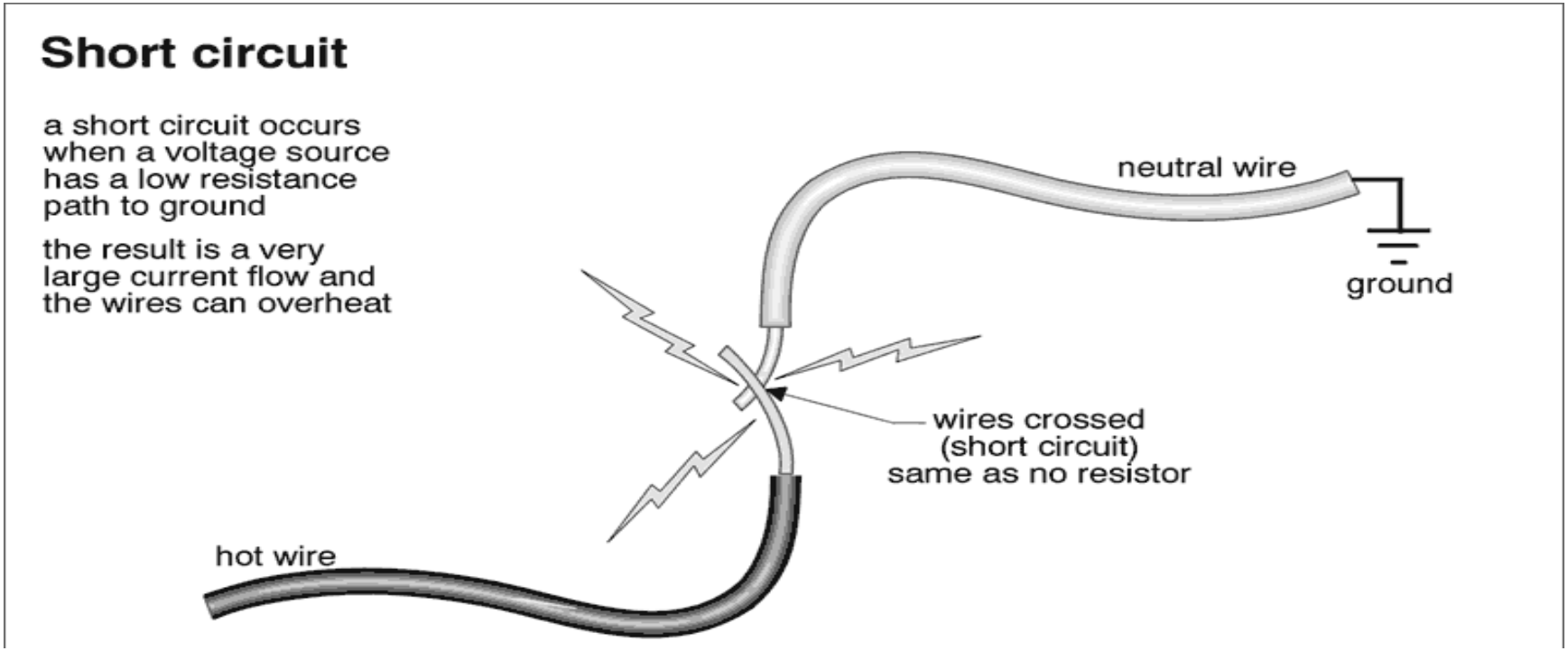
Overloaded circuits

- **When too electrical devices are drawing power from a 120 V outlet, the overall resistance of the circuit is lowered.**
- **That means the electrical wires carry more than a safe level of current.**
- **When this happens , the circuit is *overloaded***
- **High current in overloaded**



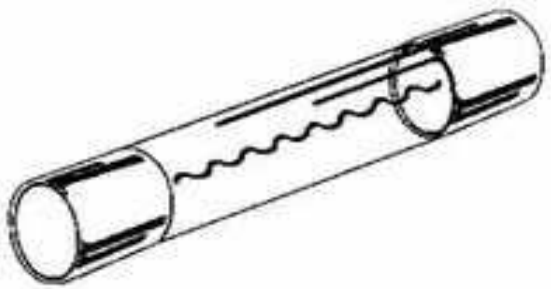
Short Circuit

- **Worn insulation on wires can also be a fire hazard. If two bare wires are able to touch a shorter pathway is presented to the flow of the current. This is called a *short circuit*. Short circuits are very dangerous and can be reduced by grounding outlets.**



Fuse – device containing a metal strip that melts when a current in the circuit becomes too much

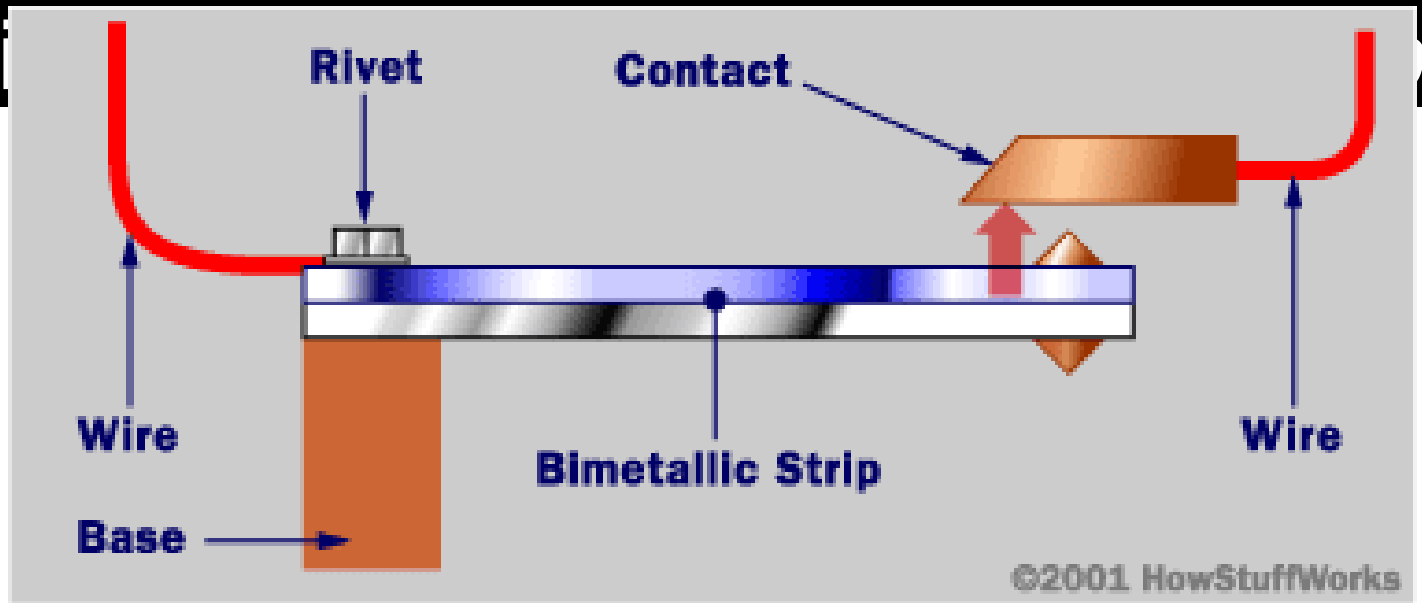
- **To prevent overloading a circuit, fuses are connected in series along the supply path. A fuse is a ribbon of wire with a low melting point if the current in the line becomes too large, the fuse melts and the circuit is open. If a fuse blows that** **that more than 20 A of current** **through it.**



Would a fuse have to be wired in series or in parallel to protect

Circuit breaker – a device that protects a circuit from current overload.

- **Circuit breakers open circuits with high current. A circuit breaker uses a magnet or bimetallic strip, that responds to current overload by opening the circuit**
- **Unli** **e**



Review Day!

1. BR QUIZ
2. ELECTRICITY WS
3. EOC REVIEW

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#1-3, 5-8, 10, 15, 18, 21

4. JEOPARDY REVIEW