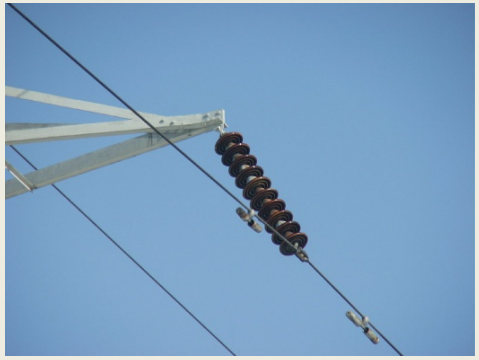
Basic Electricity

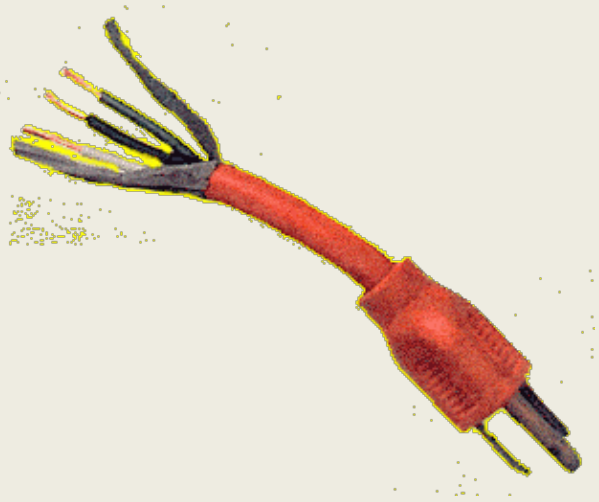
Conductor

- Something that allows electricity to flow
- Examples;
  - metal
  - Water
  - air

Insulator

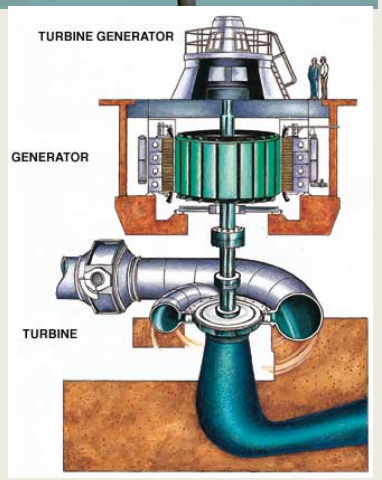
- Something that does NOT let electricity flow
- Examples
  - Glass
  - Plastic
  - Rubber
  - Porcelain





Power Source

- Something that supplies electricity
- Examples;
  - Battery
  - Generator
  - solar panel



Battery

- Portable power source that has a positive and negative.
- The negative has extra electrons that want to move to the positive side.
- What voltage are AA, AAA, C, D batteries?

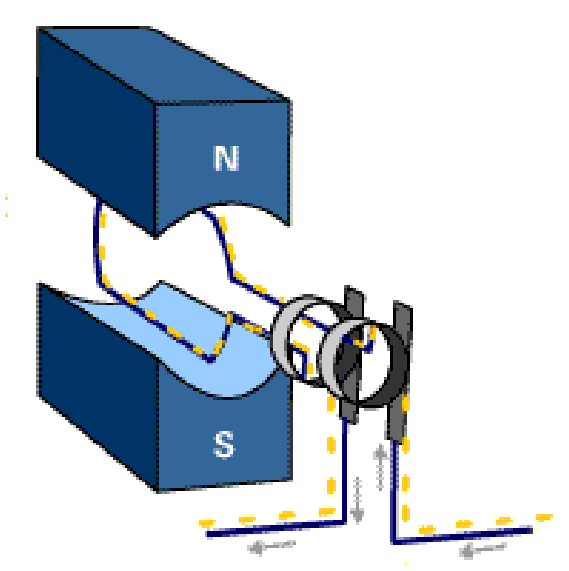
Alternating Current

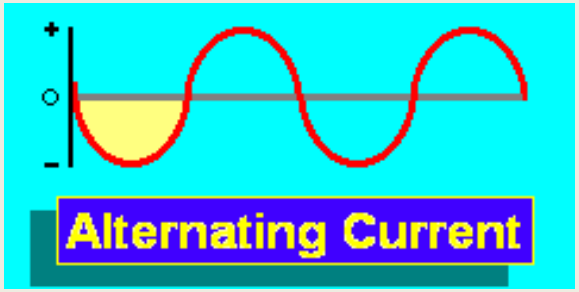
Alternating Current is a readily available power source around the world being created by hydro systems, wind turbines, coal fired generation plants and Nuclear Reactors.

In BC, the hydro electric system (Dams) provides most of our power.

The AC produced by the generators in our hydro electric system is approx. 120VAC @ 60Hz.

This voltage is TOO HIGH and is AC not DC, therefore is will not work for electronic system.

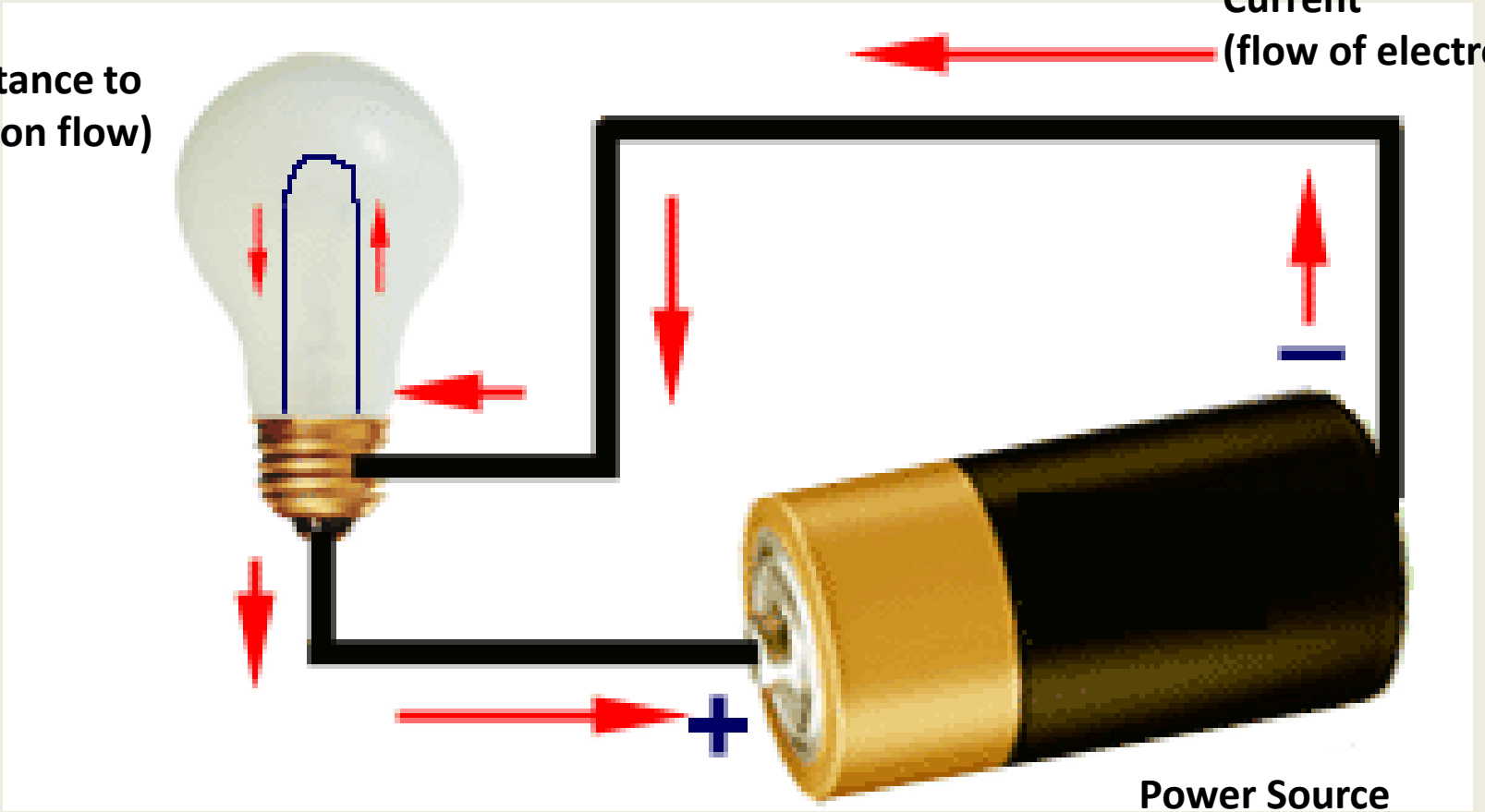




Direct Circuit

Load (resistance to electron flow)

Current (flow of electrons)



Power Source (provides the voltage)

Forms of Electricity & Knowing its there

Light

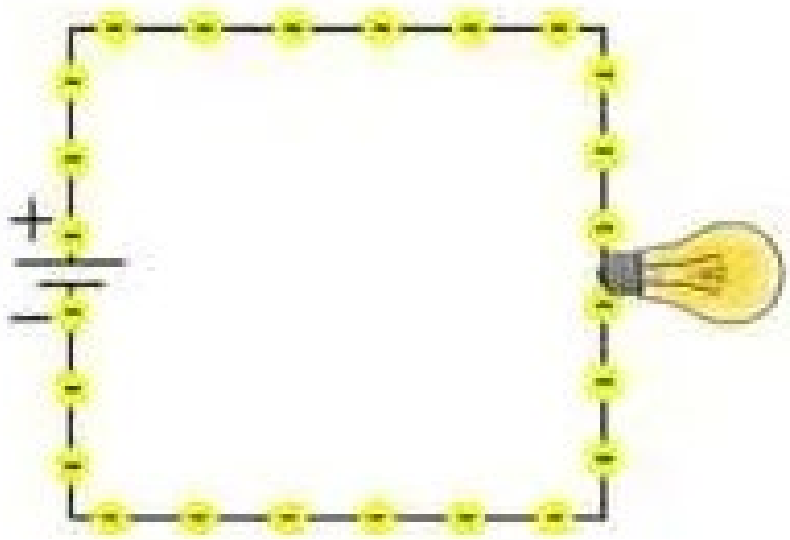
Motion

Heat

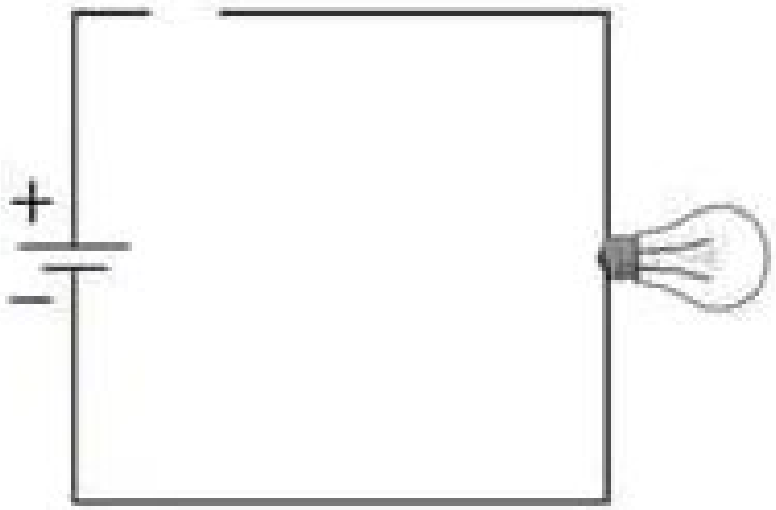
Sound

When it’s not there use a Multimeter

Circuits

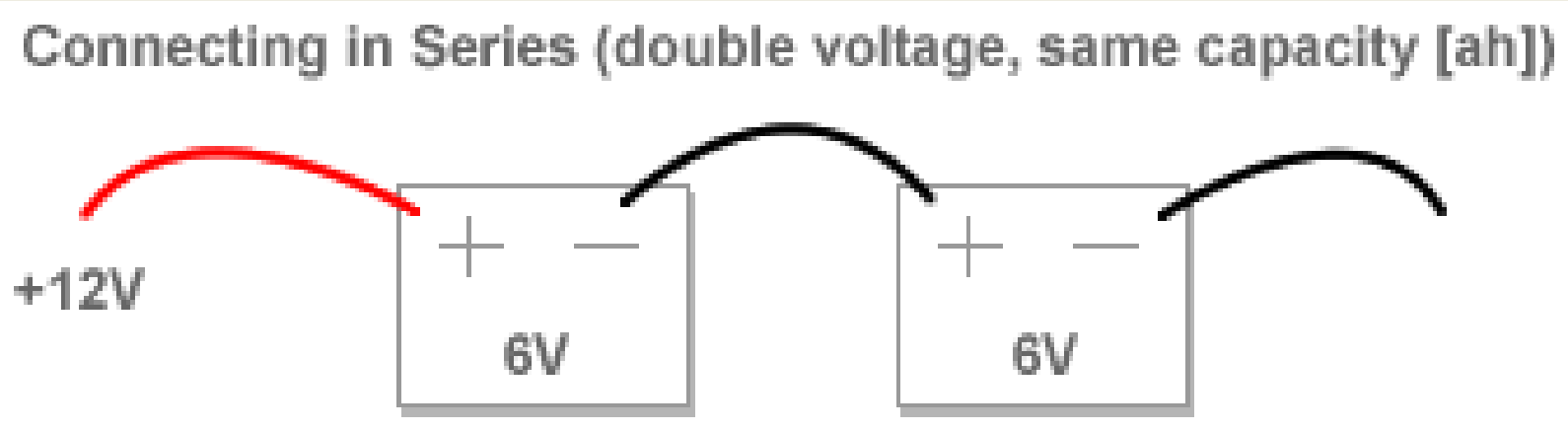


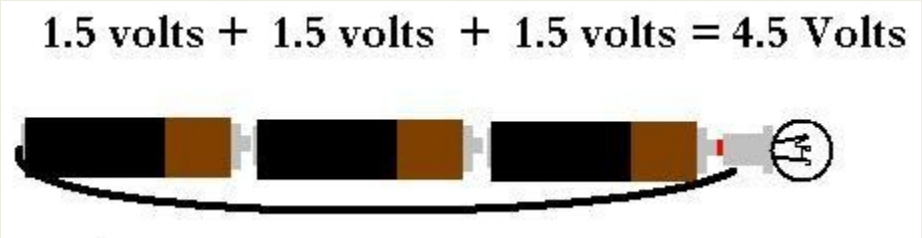
closed circuit

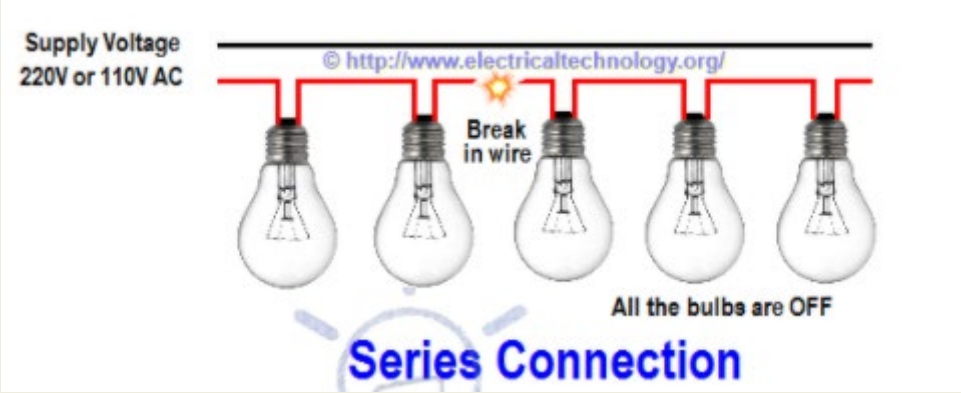


open circuit

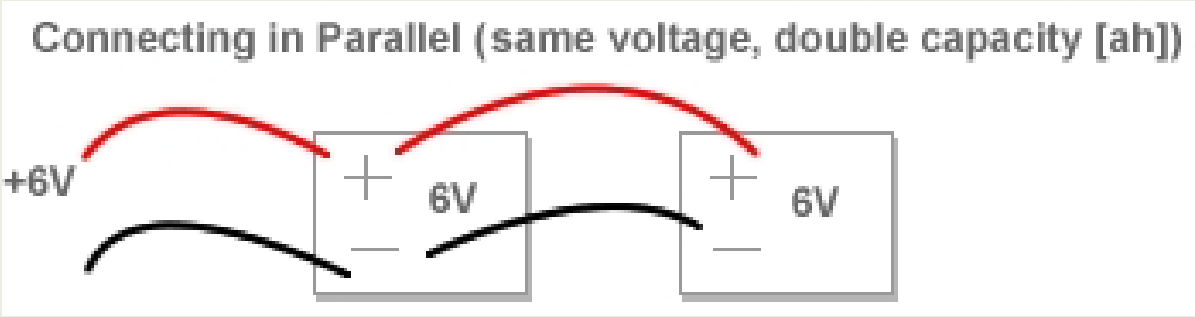
Electrical in Series

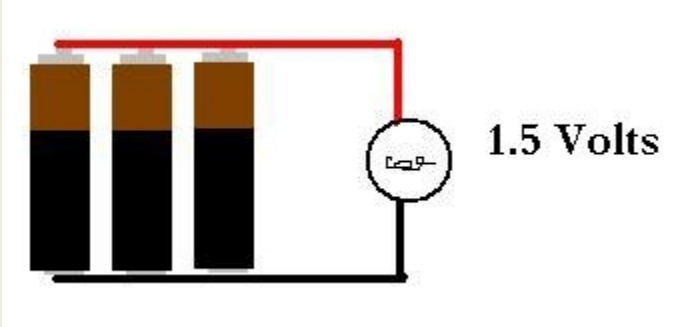




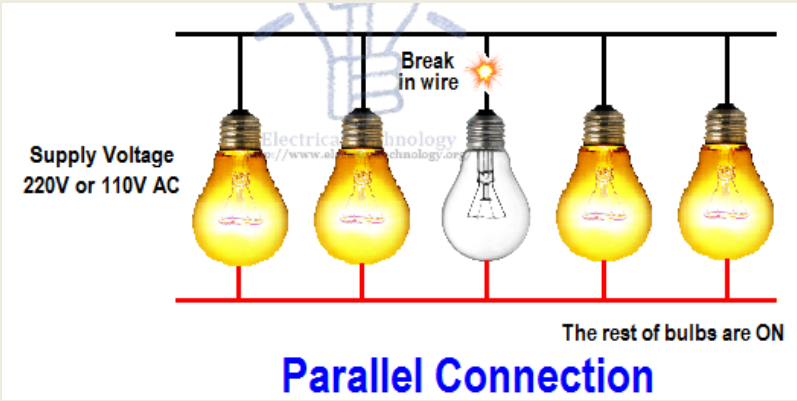


Electrical in Parallel





The voltage stays the same, but the amperage increases.



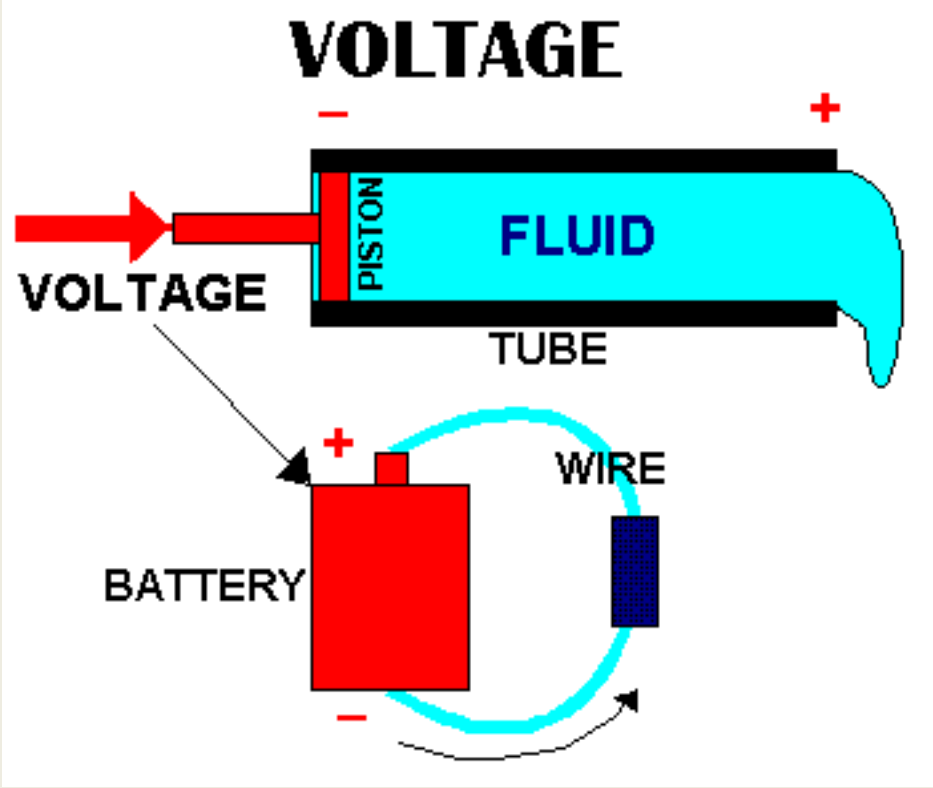
Load

- Something that uses electricity

Voltage

- The force or pressure needed to move electrons in a circuit. The unit of measure is the **volt**

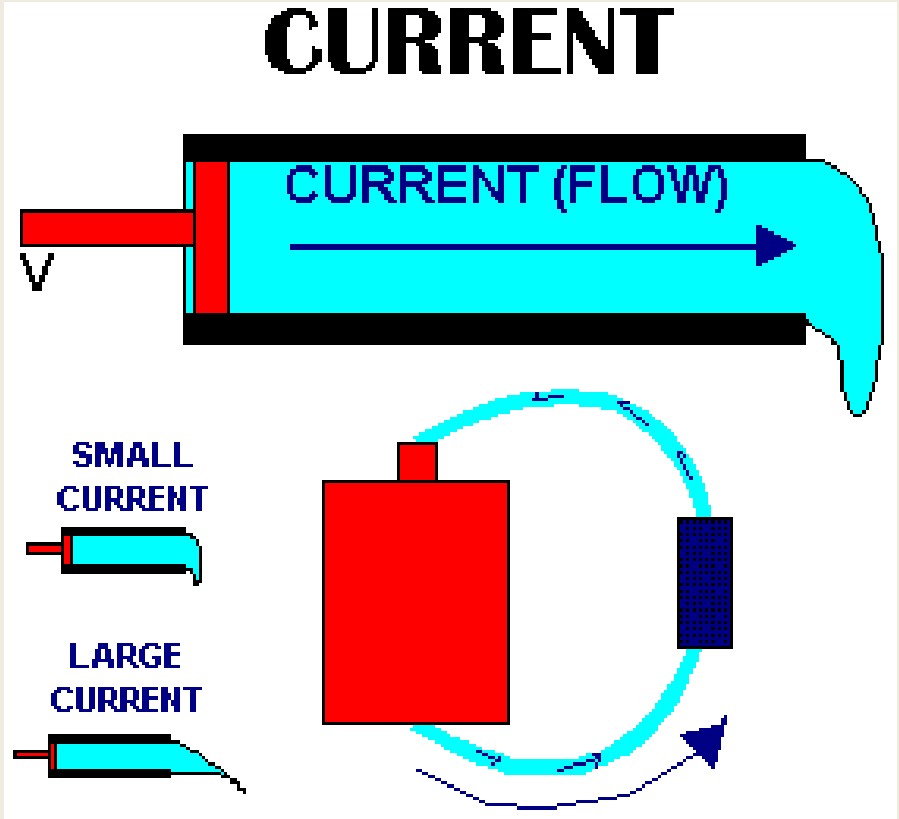
- Expressed as “V or E”



Syringe example

Current

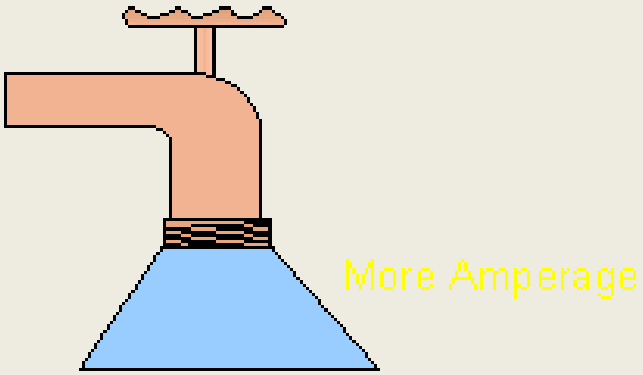
- The name given to the flow of electrons in a circuit. The unit of measure is the Ampere.
- In electronic circuits, electrons flow from negative to positive.
- Expressed as “I”



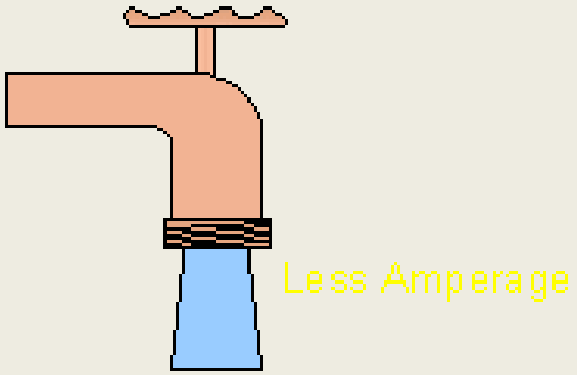
Resistance

Restriction of the flow of electrons (current) in a circuit.

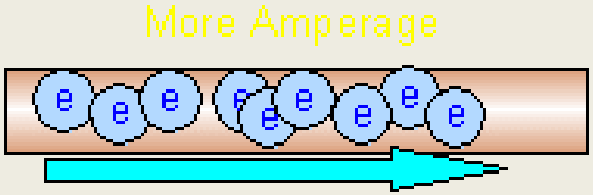
The unit of measure is the Ohm. The **less** resistance (open up faucet), the **greater** the current flow, the **more** resistance (close the faucet), the **less** the current flow

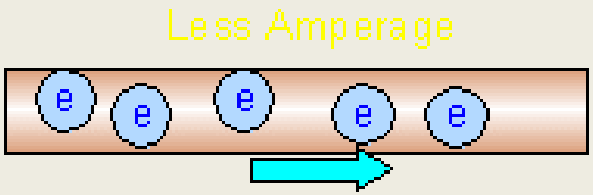


More Amperage



Less Amperage





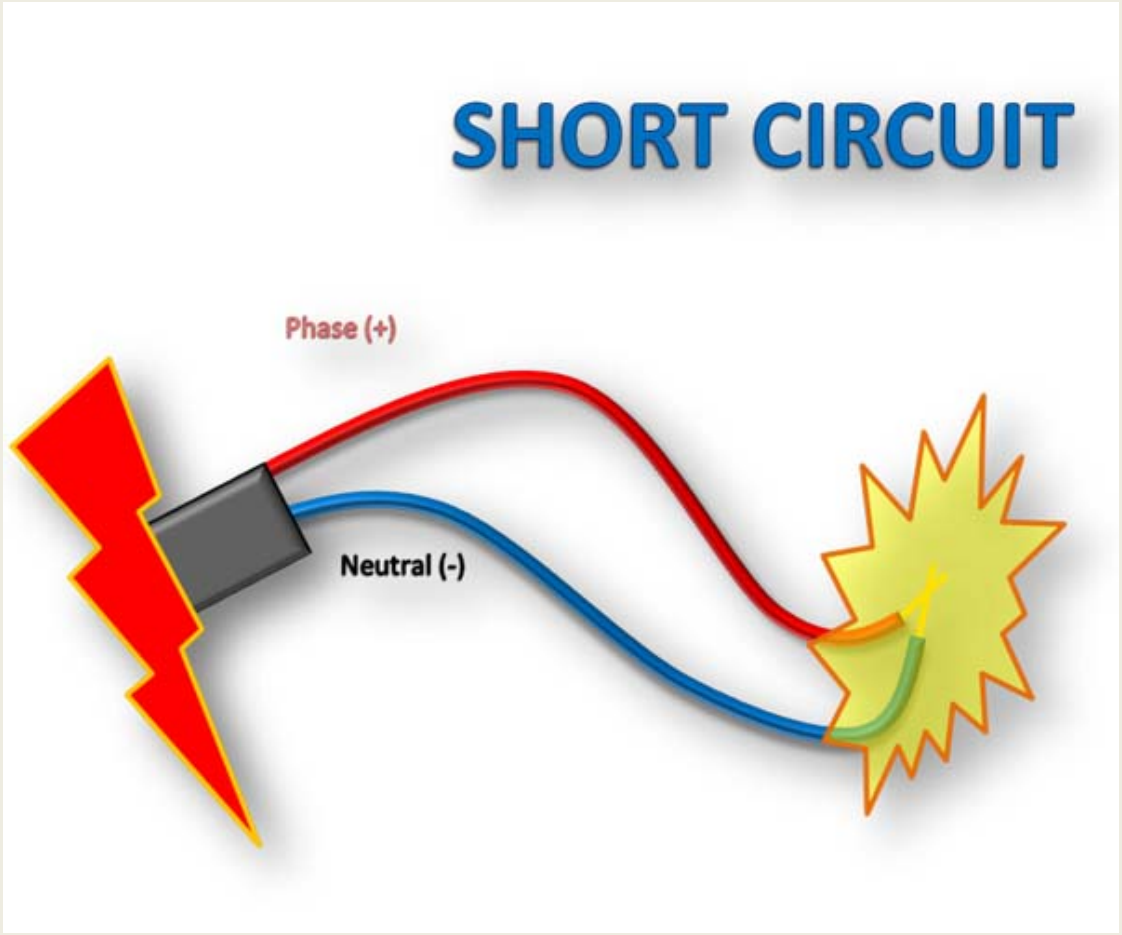
Electrical Components and Their Characteristics Disclaimer

All electrical/electronic components require voltage and current to make them work. When working with electrical/electronic components it is **VERY IMPORTANT** to understand that these components will only work properly when the correct voltage and current are supplied to them.

All electrical/electronic components are **RATED** for a specific range of voltage and current. Exceeding these ratings results in decreased life expectancy or failure of the component.

Short Circuit

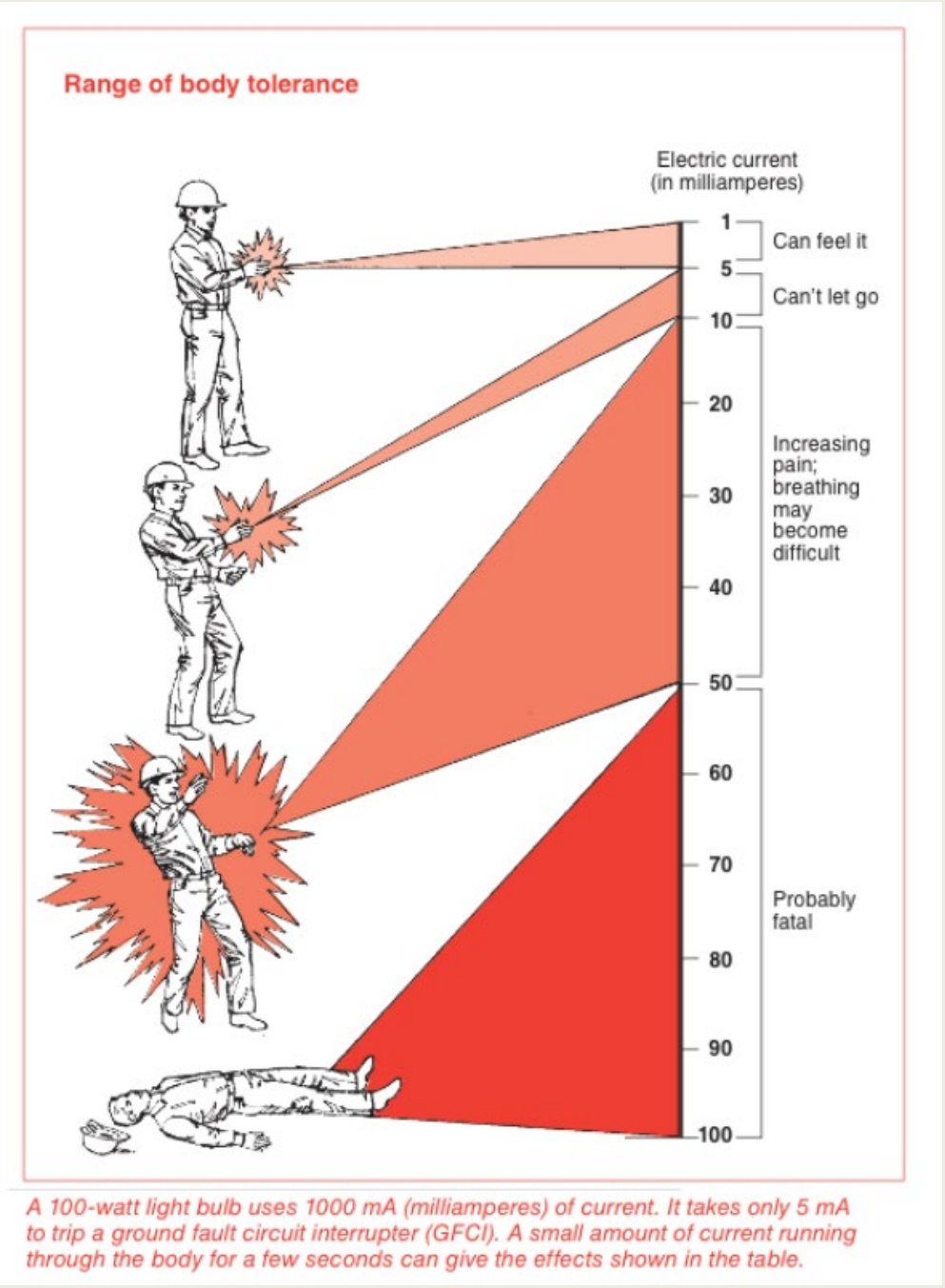
a path of low resistance allowing a high current to flow



Electricity can Kill

The body has a natural resistance that is highest at the skin

The dryer the skin, the higher resistance



Ohm’s Law

Ohm's Law

- Ohm's Law is the relationship between voltage, current and resistance.

  The law states: One ohm is the resistance value through which one volt will maintain a current of one ampere.

  V = Voltage

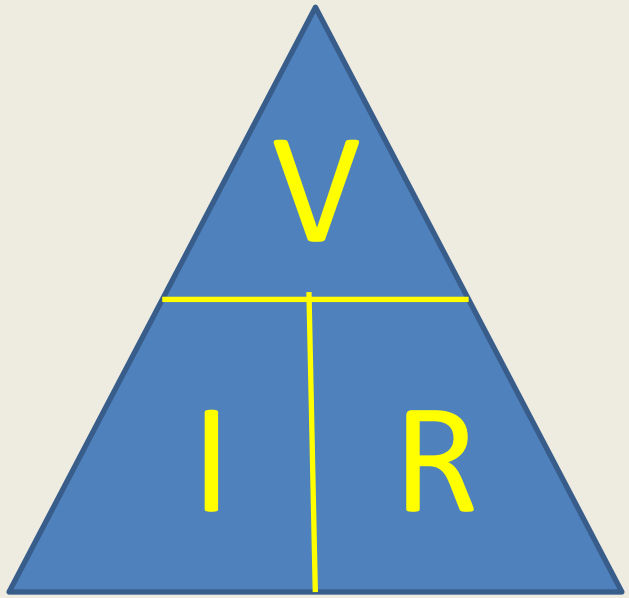
  I = Current (in Amps)

  R = Resistance in Ohms (Ω)

  Example: **V = I x R**

  V = 1A x 1Ω

  V = 1volt



V = I x R

Ohm's Law Continued

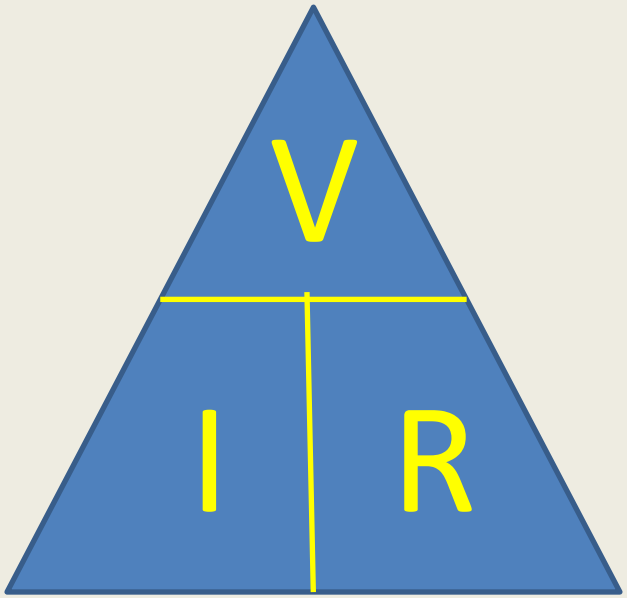
- In a circuit you know the voltage and therefore V = I x R isn't the most useful. However, you can change the formula around to solve for resistance and current .

V = I x R

can be changed to

I = V / R

to solve for current



V = Voltage, I = Current, R = Resistance

Example: Supply of 10volts and a 100Ω resistor, what is the current in the circuit?

I = V / R

I = 10V / 100Ω

I = .1A

The current running through the circuit is .**1A**.

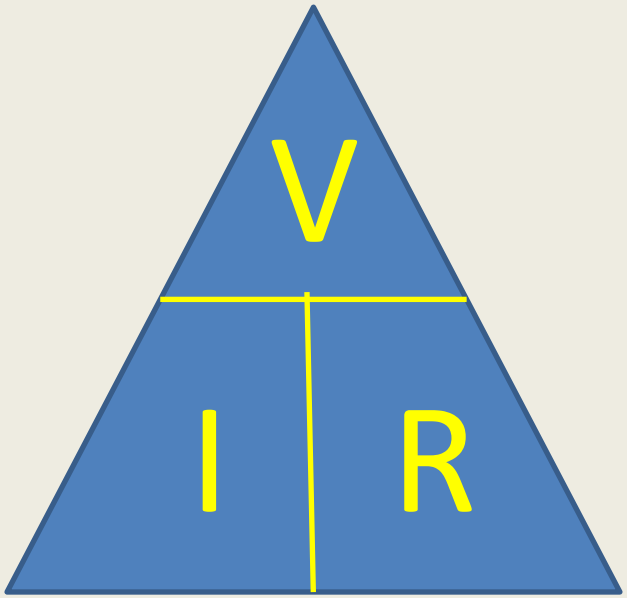
Ohm's Law Continued

- All components require a specific amount of current to work. Therefore, the **most** useful use of Ohm's Law in electronics is to solve for **resistance**.

V = I x R

can be changed to

R = V / I



V = Voltage, I = Current, R = Resistance

Example: You have a 10volt supply and require a .01A (10mA) current to run an electrical component, what resistance is needed?

R = V / I

R = 10V / .01A

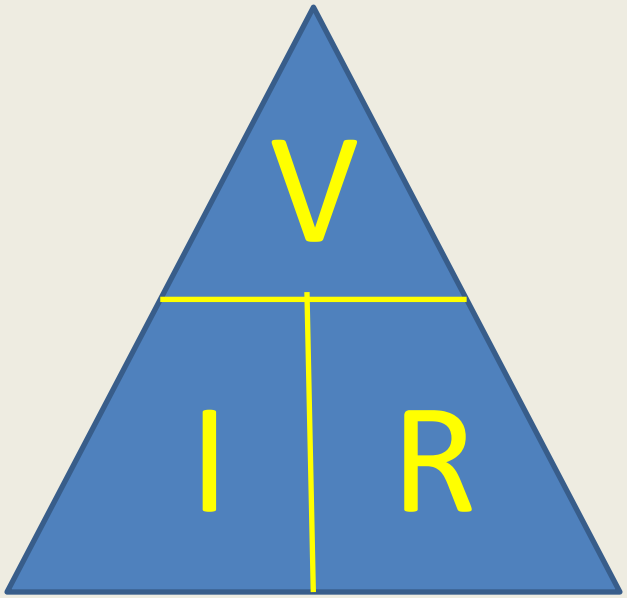
R = 1000Ω

The resistor needed is **1000Ω**.

Ohm's Law Examples

Solve for the missing value

Voltage (volts)	Current (Amps)	Resistance (Ohms)
20	2	10
10	2	**5**
5	**.05A (50mA)**	100
10	.02	**500**
5	**.005A 5mA**	1000



V = Voltage, I = Current, R = Resistance

$V = I \times R$

$I = V / R$

$R = V / I$

Watt’s Law

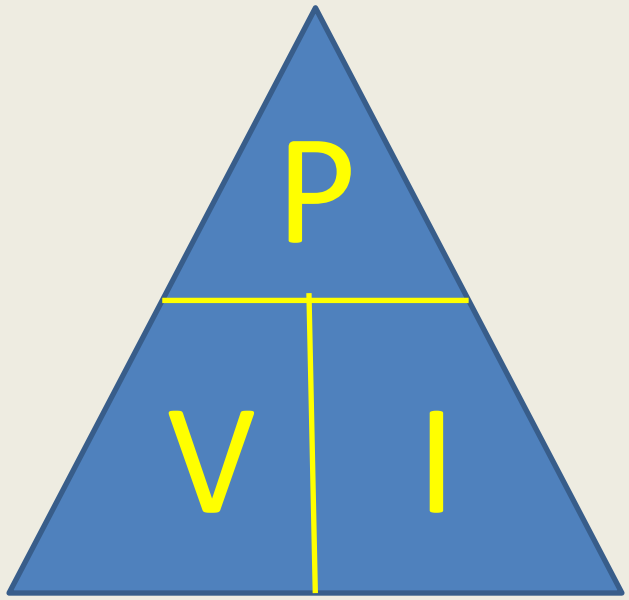
Watt's Law

- When electricity is being used by a load (Air compressor, circular saw, fridge, toaster, lights in a shop, etc), the electrical energy is being converted into another form (light, heat, motion).

- **Power** is the amount of electrical energy being converted by a load. The unit of measure is the Watt.

  Calculating Power;

$$P = V \times I$$



P = Watts, V = Voltage, I = Current

Watt's Law Continued

Examples

You have a voltage of 120v and a current of 10A for a mitre saw, what amount of power is being consumed?

P = V x I

P = 120V x 10A

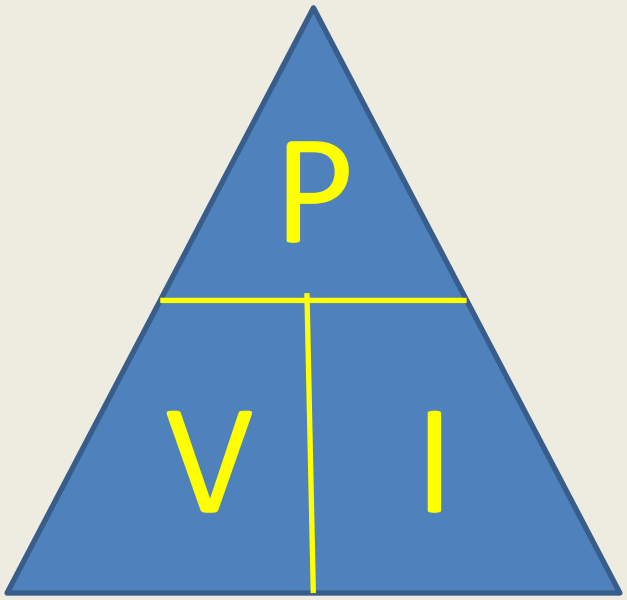
P = 1200W

You have light bulb that is 60W in your house. How much current is the light bulb drawing?

I = P / V

I = 60W / 120V

I = .5A



P = Watts, V = Voltage, I = Current

$$P = V \times I$$

$$I = P / V$$

$$V = P / I$$

Watt's Law Questions

1) How many Watts does a 4 amp, 120v router produce?

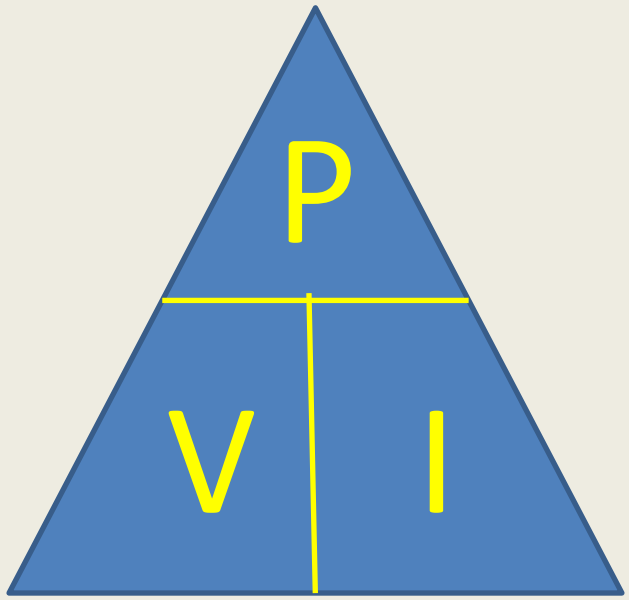
2) How many Amps does a 600W 120v jigsaw draw?

3) How many volts is a 200Watt, 10amp Dewalt cordless drill?

4) Can a 1500W portable generator run two 120V 5amp Circular Saws at the same time?

5) Can my 1500W wife's blow drier work on a generator that produce 120v @ 10 amps maximum?

6) Can a 100watt solar panel on my camper run a 12V, 5 amp fan to run my propane heater and not kill the battery during the day in sunshine?



P = Watts, V = Voltage, I = Current

$$P = V \times I$$

$$I = P / V$$

$$V = P / I$$