

What is Electricity

- Electricity is the energy caused by moving electrons within an atom.
- Electrical energy is the energy of electric charges.

proton [positive charge (+)]

electron [negative charge (-)]

an atom

When electrons move from one atom to another atom, it produces electricity.

ELECTRIC CHARGE

Electricity is related to charges, and both electrons (-) and protons (+) carry a charge.

Electric charge is an electrical property of matter.

All matter is made of atoms that contain electrons, neutrons, and protons

An object can have a negative charge, positive charge or no charge.

ELECTRIC CHARGE

Charge of proton **Positive**

Charge of electron **Negative**

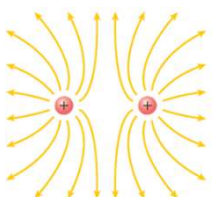
Charge of neutron **NONE**

Atoms have no charge because the charges of the protons and electrons cancel each other out.

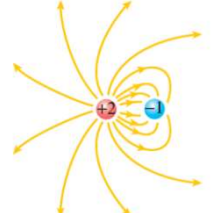
Atoms become charged by gaining or losing electrons

ELECTRIC CHARGE

- Charges in objects can produce a force between the objects
- Objects are forced together or attracted when their charges are different
- “Opposite charges attract”
- Same electric charges they push apart
- “Like charges repel”

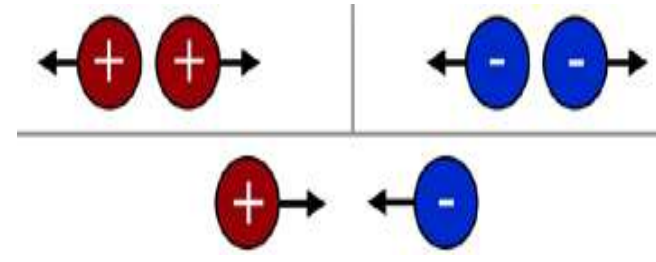



Like charges REPEL





Opposites attract!

Like Charges Repel Opposite Charges Attract





STATIC ELECTRICITY

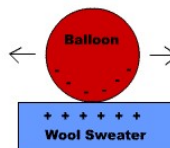



Static electricity- buildup of excess negative charge on an object

- Excess **electrons** on an object
- Very short electric discharge

Static electricity is electricity at rest

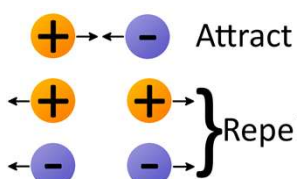
Friction can cause it



Electric Force

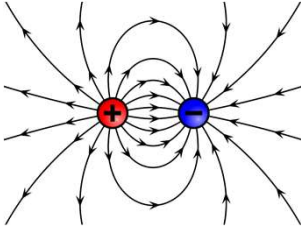
Electric force: the force of attraction or repulsion on a charged particle that is due to an electric field.

- Force depends on charge and distance.
- Acts through a field



Electric Force


- Electric field: the space around a charged object in which another charged object experiences an electric force.



SECTION 2: ELECTRIC CURRENT

Voltage: difference in energy per unit charge as the charge moves between two points in the path of a circuit

Higher voltage, the more work the electrons can do.

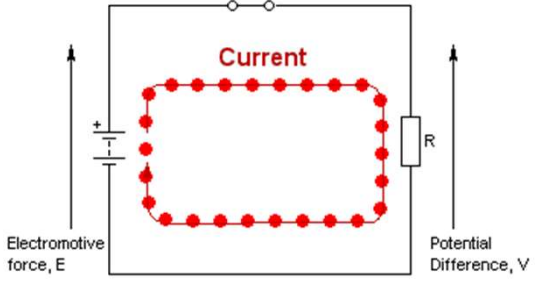


Voltage can vary

CURRENT

Electric current: the flow of electricity/electrons through a wire or any conductor.

- Used to make electrical appliances to work

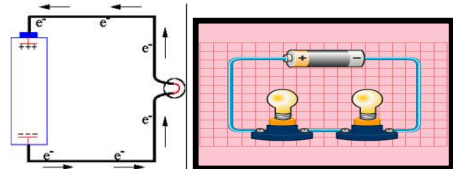


ELECTRIC CURRENT

- Measured in units of Amperes (A)
- Different from static electricity because it lasts longer

Charges flow from High voltage to Low voltage

For charges to flow, the wire must always be connected in a closed path, or circuit




ELECTRIC CURRENT

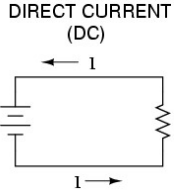
There are two main kinds of electric current,

- Direct current (DC)
- Alternating current (AC).

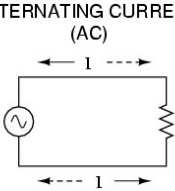
Explains how current gets moved

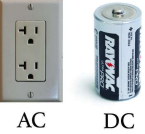


DIRECT CURRENT (DC)



ALTERNATING CURRENT (AC)






AC DC

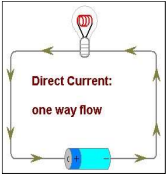
ELECTRIC CURRENT

DIRECT CURRENT

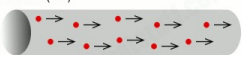
(DC) Direct current is a flow of charge always in one direction.

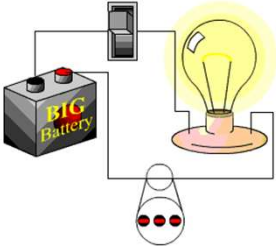
From batteries





Direct current (DC) www.explainsstuff.com





ELECTRIC CURRENT

ALTERNATING CURRENT


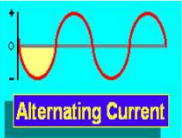
(AC) -Alternating current is a flow of charge back and forth, changing its direction many times in one second.

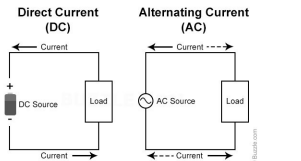
- (Plugs and outlets / household)

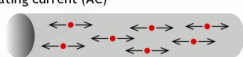
Mainly used today

Advantages of AC

- Voltage can be raised or lowered
- More efficient over long distances
- From Generators
- Used in your home
- Transformers change AC to DC





ELECTRICAL RESISTANCE

Resistance- the tendency for a material to oppose the flow of electrons, changing electrical energy into Thermal energy and light

- Opposition to the flow of charge
- All materials have some electrical resistance
- **Increasing resistance by the following:**
 - Making wires thinner
 - Making wires longer
 - Increasing temperature

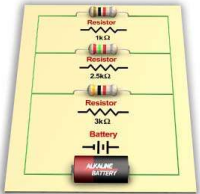



Figure 4

As resistance increases... current decreases!!!!

- Measured in ohms: omega Ω



CIRCUITS

Resistance is supplied by a resistor.

A **resistor** is a device that uses electric energy to do work.

A wire connected from the resistor to the positive terminal completes the circuit.

OHM'S LAW

Ohm's law states that the current in a circuit is equal to the voltage divided by the resistance

What is the formula if solving for R?

What is the formula if solving for V?

$$I = \frac{V}{R}$$

The relationship among current, voltage, and resistance.

Units

I = Current → Amperes (A)
 V = Voltage → Volts (V)
 R = Resistance → Ohm (Ω)

PRACTICE PROBLEMS: RESISTANCE

1. A car has a 12 volt system. The headlights are on a 10 amps circuit. How much resistance do they have?

V= 12 volts R= V/I R= 12 volt/10 amp **R= 1.2 Ohm (Ω)**
 I= 10 amps
 R= ?

2. Your house uses 120 volts. What amount of current would flow through a 20 ohm resistor?

V= 120 volts I= V/R I= 120 volts/20 ohm **I= 6 Amps**
 I= ?
 R= 20 ohm

PRACTICE PROBLEMS: RESISTANCE

3. A refrigerator's circuit has a current equal to 0.647 A in it when the voltage across the circuit equals 116 V. What is the resistance of the circuit?

V= 116 volts R= V/I R= 116 volts/0.647 amps
 I= 0.647 amps **R= 179 ohms(Ω)**
 R= ?

4. The resistance of a wire in a hair dryer is 7.7 Ω . If the current through the wire equals 15.6 A, what is the voltage across the terminals of the hair dryer?

V= ? V= I x R V= 15.6 amps x 7.7 Ω **V= 120 Volts**
 I= 15.6 amps
 R= 7.7 Ω

CIRCUITS

Closed Circuit- A closed-loop path for electrons to flow through, creating a current

(a)

Open Circuit- if any part of the circuit is disconnected, no current flows

(b)

SCHEMATIC DIAGRAM SYMBOLS

Wire or conductor 		Battery or other direct current source 	
Resistor 		Switch <p style="text-align: center;">Open</p>	<p style="text-align: center;">Open</p>
Bulb or lamp 		<p style="text-align: center;">Closed</p>	<p style="text-align: center;">Closed</p>

TWO TYPES OF CIRCUITS

Series circuits: A circuit with only one path.

All the resistors in a series circuit lie along a single path.

The amount of current in a series circuit is the same at all parts of the circuit.

Resistance in the circuit changes if resistors are added or taken away.

Series Circuits

Break in the wire turns off all the lights

ADVANTAGES & DISADVANTAGES OF SERIES CIRCUIT

Disadvantages

1. If one component in a series circuit fails, then all the components in the circuit fail because the circuit has been broken.
2. The more components there are in a series circuit, the greater the circuit's resistance*.
3. There is less voltage going through each light bulb making them dimmer.

Advantages

1. It costs less to make
2. It is easier to make

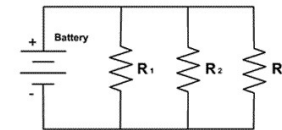
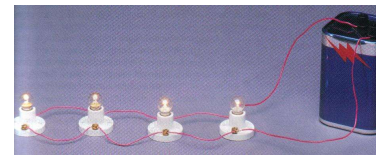
TWO TYPES OF CIRCUITS

Parallel circuits: The electrons in a parallel circuit can travel through more than one path, each path is separate.

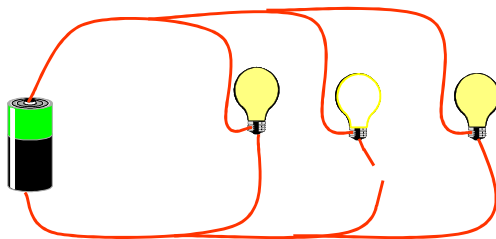
If there's a break in one path in the circuit, electrons can still flow through the other paths and maintain a complete circuit.

Parallel circuits in your home allow each light or appliance to use the amount of current it needs to work.

A parallel circuit prevents all the lights or appliances from shutting off when one of them stops working.



Parallel Circuit



[Series vs. Parallel Circuit Video](#)

ADVANTAGES & DISADVANTAGES OF PARALLEL CIRCUIT

Disadvantages

1. More difficult and complicated to assemble.
2. Splits current

Advantages

1. It becomes easy to connect or disconnect a new element without affecting the working of other elements.
2. If there is a break in one branch, charges can still move through other branches.
3. Switches can be added to turn on different part.
4. Resistance decreases and current increases.

