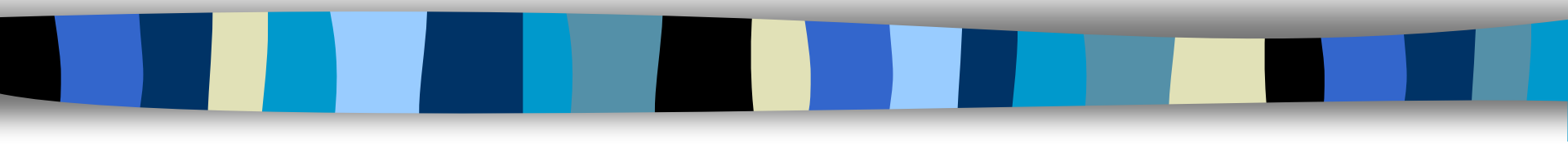
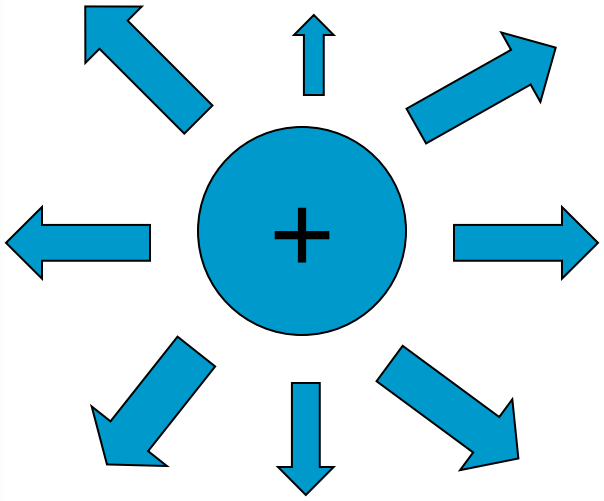
Chapter 33 - Electric Fields and Potential

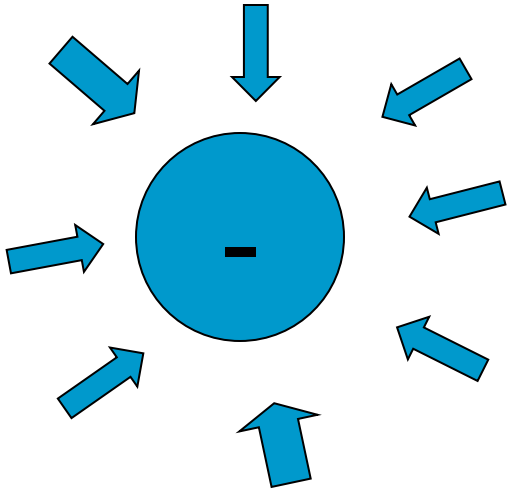


Chapter 34 - Electric Current

Electric Force acts through a field

An electric field surrounds every electric charge. It exerts a force that causes electric charges to move.





Electric Potential Energy

- The amount of work required to move a charge between two points and overcome electrical repulsion = the energy gained by the charge
- If the charge gets released, it will accelerate and the potential energy will become kinetic energy

Electric Potential

- How much potential energy is in each individual charge
- Electric potential = $\frac{\text{electrical potential energy}}{\text{charge}}$
- 1 Volt = 1 $\frac{\text{joule}}{\text{coulomb}}$

Electric Potential Difference

- The SI unit of electric potential difference is the VOLT
- Electric potential is also called Voltage
- The electric pressure created by the voltage is what produces a flow of charge – it's the "push" that gets them moving.

Electric Current

- A flow of charge is called an electric current
- Electric current is the amount of charge that passes a given point per unit of time

Electric Current

- The symbol for current is (I)
- The unit in which current is expressed is the ampere (A)

Electric Current

- Only occurs when there is a *potential difference* or difference in voltage
- The flow of charge will continue until both ends reach a common potential.
- No potential difference = no current
- Always flows from high voltage to low voltage

It's like…

- Water flowing from high pressure to low pressure
- Fig 34.1 on pg 532
- http://hyperphysics.phy-astr.gsu.edu/Hbase/electric/watcir.html#c2
- Things falling b/c of gravity
- Temperature going from high to low

What if you take away the voltage difference?

- Then no current will flow. In order for lights to work – there has to be continual flow from high voltage to low voltage.
- Voltage source – provides a potential difference; acts as an "electric pump"
  - Dry cells, wet cells, and generators
  - Wall sockets also have a voltage difference across the two outlet holes provided by a generator at a power plant (averages 120 volts)

Voltage vs. Current

- Voltage is the pressure that pushes the current, but it doesn’t go anywhere.
- Current is the flow of charges that is pushed by voltage.

Electric Current

- 1 ampere measures the flow of 1 coulomb of charge per second past a given point

Current-carrying wire

- Does it have a charge?
  - No, because even though electrons are flowing through the wire the net charge remains zero.
  - The number of electrons entering the wire equals the number of electrons leaving the wire

Resistance – pg 534

- Opposition to the flow of electric charge is resistance
- Sources???
  - Length, size, temperature, and conductivity of the wire
- The symbol for resistance is (R)
- The unit of resistance is the ohm (Ω)

Ohm's Law

- Ohm's Law identifies the relationship among current, voltage, and resistance
- Ohm's Law states that the current in a wire (I) is equal to the voltage (V) divided by the resistance (R)

$$\text{Current} = \frac{\text{Voltage}}{\text{Resistance}}$$

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

$$\text{Amperes} = \frac{\text{Volts}}{\text{Ohms}}$$

AC / DC

- Direct Current (DC) travels in one direction.
  - Example: a battery – the electrons move in the same direction from the repelling negative terminal toward the positive terminal

- Alternating Current (AC) continually reverses its direction.
  - Electrons move one direction and then the opposite, alternating back and forth

http://www.teachnet.ie/torourke/basics.htm

- A special arrangement of four diodes can actually convert AC into DC
- What's a diode??? – pg 540

Electrons in a Wire

- Electrons move very slowly in a wire. Electrons in an AC circuit just pace back and forth.
- The electric field races along the wire very rapidly.
- Electrons moving in the circuit is what allows the circuit components to work.

Electric Power

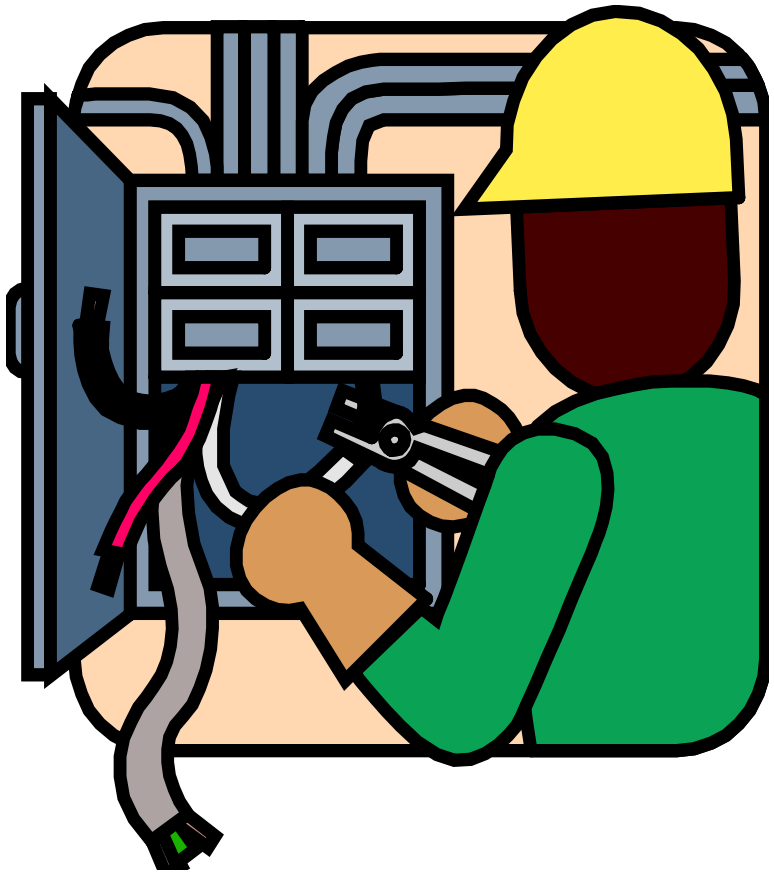
- The rate at which electrical energy is converted into another form – mechanical energy, heat, light
- Electric power = current x voltage
- 1 watt = 1 ampere x 1 volt
- Kilowatt = 1000 watts
- Kilowatt-hour = amount of energy consumed in 1 hour at a rate of 1 kilowatt

Electric Circuits

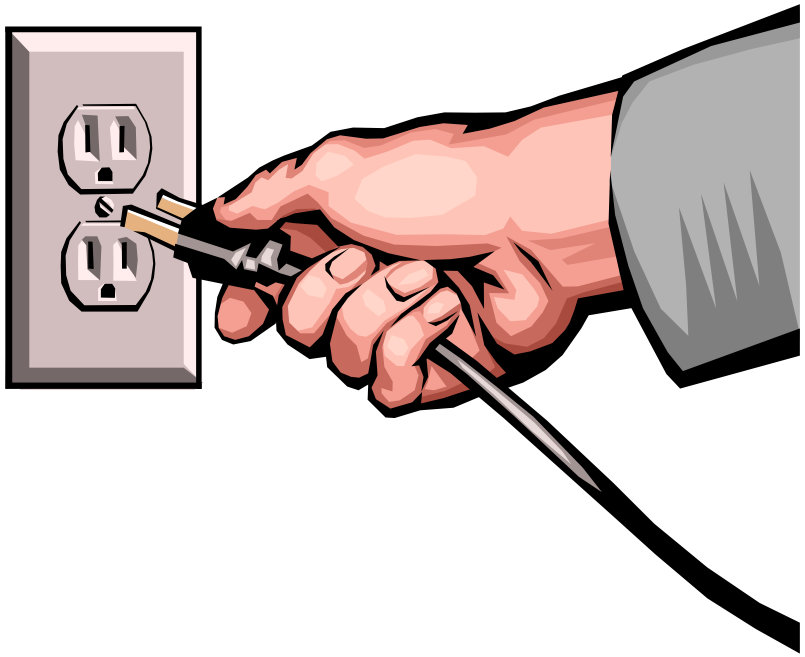
- When a wire is connected to the terminals of a source, a complete path called a **CIRCUIT** is formed

Electric Circuits

- An electric circuit provides a complete, closed path for an electric current



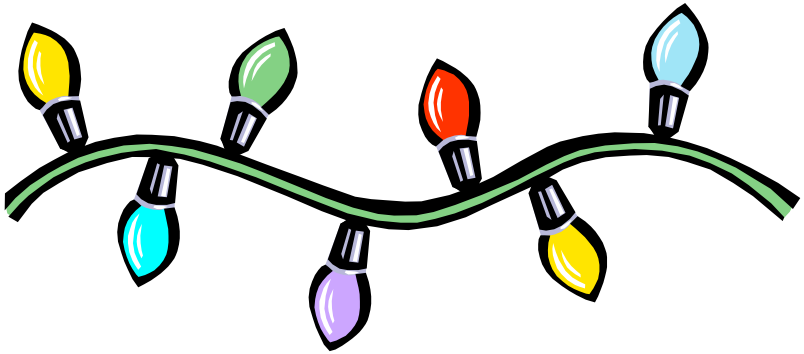
Parts of a Circuit



- Source of energy
- load
- resistance
- wires
- switch

Series Circuit

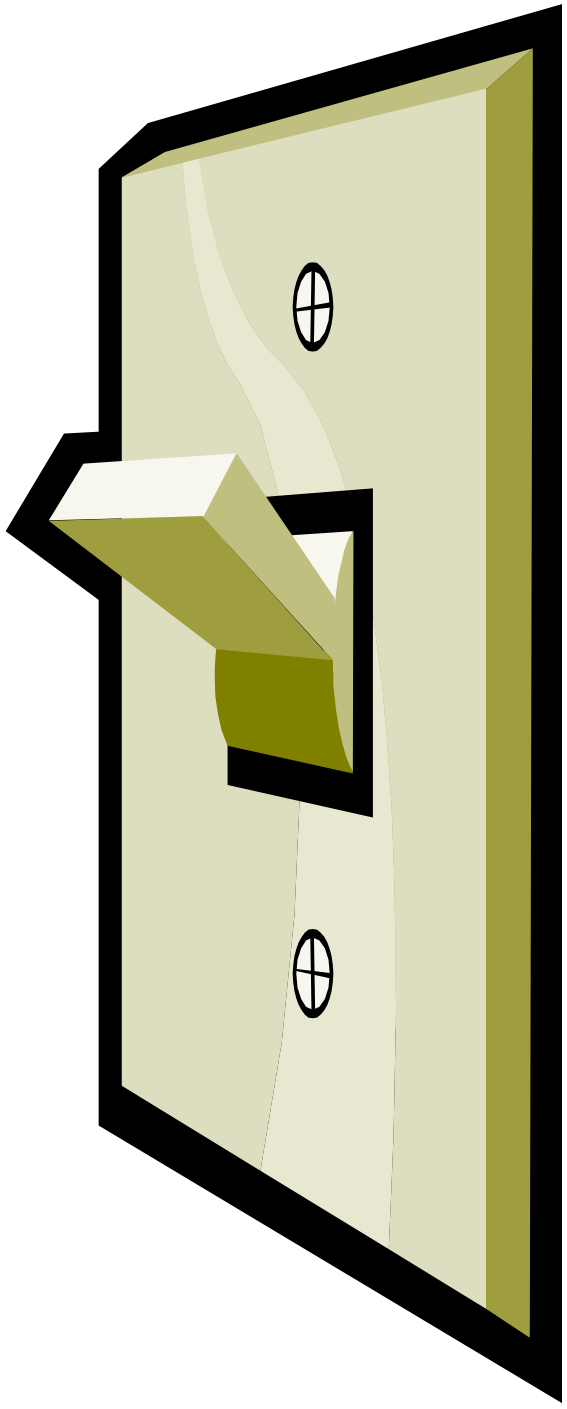
- There is only one path for the electrons to take



Parallel Circuits

- The different parts of an electric circuit are on separate branches
- If there is a break in a parallel circuit, electrons can still move through the other branches

Open Switch



Closed Switch