**Electricity & Magnetism Notes**

**Ch. 20 & 21**

**Electrical Forces and Charges**

* **Electrical Force**: Force of attraction and repulsion that either pushes or pulls electrical charges.
* **Force of Attraction**: Positive and negative charges coming together.
* **Force of Repulsion**: Either positive and positive or negative and negative charges push away from each other.

**Ions**

* Charged particles.
* How does a particle become charged?
  + Rubbing separates charges on objects.
* If an object gains electrons, the charge is **negative**.
* If an object loses electrons, the charge is **positive**.

**Static Electricity**

* Build up of charges on an object.
* Discharge of electrons occur when a charged object “touches” another object. (clothes in dryer, rubbing feet over carpet and touching another object – feeling a shock)

**Two Methods to Charge Particles**

* **Conduction**
  + Objects are charged by direct contact.
* **Induction**
  + Objects are charged by being near an object but NOT touching.

**Conductors and Insulators**

* **Conductors:** Materials that allow electrons to flow freely through it.
  + Example: Metals
* **Insulators:** Materials that DO NOT allow electrons to flow freely.
  + Examples: plastics, Styrofoam, rubber materials, wood, glass.

**How do I show objects being charged?**

* **Electroscope**: Instrument that detects charges found on objects.
* **Leaves separate**: negative charge
* **Leaves come together**: positive charge

**Flow of Electricity - Three Factors**

1. Voltage: Potential Difference (volts - V)

* Measure of energy available to move electrons.

*Push of electrons through a wire.*

1. **Current: (ampere or amps - I)**

* Flow of electrons through a wire. Increase of current means and increase in the electrons flowing through a wire.

1. **Resistance: (ohms – R or Ω )**

* Stops or slows down the flow of electrons through a wire. Plastics have a high resistance and metals have a low resistance.

**Factors that affect Resistance**

|  |  |  |
| --- | --- | --- |
| **Factors** | **High Resistance** | **Low Resistance** |
| Length of wire | Long wires | Short wires |
| Thickness of wire | Narrow opening in wire | Wide opening in wire |
| Temperature | Hot temperatures | Cold temperatures |

**Ohm’s Law**

* The current in a wire is equal to the voltage divided by the resistance.
* **Formula V = IR**
  + **I** = amps (current)
  + **V** = volts (voltage)
  + **R** = ohms (resistance)

**Ohm’s Law Practice  
V = IR**

|  |  |  |
| --- | --- | --- |
| **Volts** | **Current** | **Resistance** |
| 250 |  | 10 |
|  | 50 | 5 |
| 300 | 100 |  |
|  | 35 | 50 |

**Electrical Power**

* **Electrical Power:** Measure of the rate at which electricity does work or provides energy.
* **Unit: watts**
* **Formula: P = VI**

**Electrical Power Practice**

1. **How much power is there when a 20-A current in a light bulb has a voltage of 10-V?**
2. **A 90-W light bulb has a current of 45-A. What is the voltage in the system?**

**Electric Currents Can Either Be AC or DC.**

* **DC or Direct Current:** Electrons flow in the same direction.
  + Examples: dry cell batteries, car batteries.
* **AC or Alternating Current**: Electrons have the ability to reverse their direction.
  + Outlets and wiring in a home or business.

**Circuits**

* A pathway in which the electrons flow.
* **Open Circuit:** Switch is involved which can stop the flow of electrons.
* **Closed Circuit:** No switch which means electrons flow automatically.

**Types of Circuits**

* **Series:** One pathway
* **If a light bulb goes out, the flow of electrons stops.**
* **Parallel:** Multiple pathways that branch off the “series” circuit.
* **If a light bulb goes out in a branch, the other bulbs will still light**

**Magnetism**

* Force of attraction or repulsion between two objects.

**Force of attraction**: North and South Poles are attracted to one another.

- Opposites attract.

**Force of repulsion:** Same poles repel one another.

- N and N or S and S.

**- Strongest forces are found at the poles.**

**Breaking Magnets**

**If I split a magnet in two equal part, what would I get?**

- Two smaller and equal magnets.

**Magnetic Field**

* The closer you are to the poles, the stronger the magnetic attraction or repulsion.

**Parts of a Magnet**

* **N** on a magnet points to Magnetic North
* **S** on a magnet points to Magnetic South

**Temporary vs. Permanent Magnets**

* **Temporary:** easily magnetized but loses strength quickly.
* **Permanent:** hard to magnetize but keeps its strength a long time.
* Magnetic elements: cobalt, nickel, iron, aluminum

**Solenoid and Electromagnets**

* Electricity is used to make magnetic materials.
* **Parts** of an electromagnet:

wire, battery, nail

* **Examples:** motors, door bells, washing machines, telephones, telegraphs.

**Galvanometer and Electromagnetic Induction**

* An instrument used to detect small currents by using electromagnetic induction.
* **Electromagnetic Induction:** Using mechanical energy to produce electrical energy.
  + Example: generators

**Motor vs. Generators**

* Oerstead
* **Motors:** converts electrical energy to mechanical energy.
* Uses electromagnets
* Faraday
* **Generator:** converts mechanical energy to electrical energy.
* Uses electromagnetic induction.

**Transformers**

* Increases or decreases voltage in AC. Has primary and secondary coils in the “boxes”.
* **Types:**
  + ***Step Up***: INCREASES

***Step Down***: DECREASES