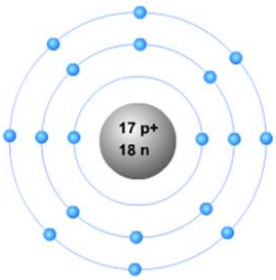
Week 34 – SCIENCE NOTE PAGE
Electric Charge & Currents

Review

- Parts of an Atom
  - Every atom has *positively* charged **protons**
    - Each proton has a charge of: **+1** (positive)
  - And, negatively charged **electrons**
    - Each electron has a charge of: **-1** (negative)
- Atoms are **NEUTRAL** (no charge) when protons **equal** electrons
- **Ions:** atoms with **unequal** numbers of protons and electrons
  - Ions are positive when there are more protons than electrons
  - Ions are negative when there are more electrons than protons



What happens when charges "meet"?

- **Opposite** charges **attract** each other
- **Like** charges **repel** each other
- **Force of Attraction** between these particles is the same force that keeps negatively charged electrons attracted to and orbiting the nucleus of an atom

Large Objects Have Electric Charges

- Everyday objects can have electric charges.
  - This occurs when the atoms of the object gains or loses **electrons**
- Example: Balloon rubbed with wool.
  - Electrons **move** from atoms in the wool to atoms in the balloon
  - The balloon takes a negative charge
  - When close to a wall, the electrons in the balloon **repel** the electrons in the wall, forcing the positive protons in the wall to the wall's surface
  - When the wall surface and balloon are oppositely charged, the balloon is **attracted** to the wall.

Electric Fields

- Electric Field: the influence throughout a **space** due to one or more electrically charged particles or surfaces
  - The **strength** of a particles' electric force on other objects depends on the objects' **distance** from the charge
  - The field is **stronger** at a point **closer** to the charge than it is at a point farther away.
  - The effect of two charges on one another **DECREASES** as the charges move **farther** apart

Electric Force

- The **electric force** between two charges (or charged objects) depends on **TWO things**:

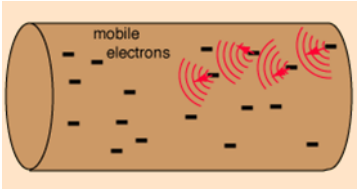
  #1. The amount of **charge** on each object
    - As the **charge increases**, electric force **increase**

#2. The **distance** between the objects/charges

- As **distance increases**, electric force **decreases**

What Happens to Electric Charges?

- Electric charges can either build up on the surface of an object, or they can move
  - When charges **build up**, we call this **STATIC** electricity
  - When charges **move**, we call this electric **current**
- **Electric current**: the **flow** of electrons through a wire (or other material)



Conductors Carry Currents

- **Conductor**: any material through which electricity can **easily** flow
  - **Metals** are good conductors because they freely allow electrons to move inside of them
  - Ex. Copper, aluminum, gold, silver

Insulators Stop Currents

- **Insulator:** a substance that **cannot** conduct electricity very well.
  - Think of an insulator stopping the flow of electricity as a dam stops the flow of water
  - **Good Insulators:** glass, porcelain, rubber, plastics
  - NOT Good Insulators: water, wax

Resistance and Electrical Currents

- There is **NO** such thing as a "**perfect**" insulator
  - Even excellent conductors will slow down current
  - Even excellent insulators will allow electrons to flow if they become "overwhelmed"
- **Resistance:** the quality of a substance that **hinders** the flow of electrons through it
  - ALL materials hinder the flow of electrons to some degree (conductors less than insulators)
  - As electrons encounters resistance, they **slow** down
- When electrons encounter resistances and slow down, **WHERE does their energy go?**
  - The energy is converted to **HEAT**
  - **Examples** of household devices that use resistance: light bulbs, electric oven, toaster, space heater

What Makes Electricity Flow?

- Because electrons repel one another and are attracted to objects with a positive charge, they will flow from **NEGATIVE** to **POSITIVE.**
- In order to create current, you must first find a way to create this **DIFFERENCE** in charge
- This is called an electrical "potential" or **VOLTAGE**
- We can make electricity flow by using: batteries, generators, solar panels

Can Electrons Be Used Up?

- NO – electrons are **never** destroyed (remember Law of Conservation of Energy)
- BUT….It is possible for electrons to reach a "dead end" and **stop** moving.

Keeping Electrons on Track

- Electricity flows in a **current** and can be used to do **work** such as lighting a light bulb
- Electric currents that provide a continuous **push** to keep the electrons flowing allow household appliances to work
- Examples: TV, Lights, Computer, Xbox, Electric Ovens