IMPORTANT TERMS:

- **Charge**
- **Conductor**
- **Conservation of charge**
- **Coulomb**
- **Coulomb's Law**
- **Electrical force**
- **Electrically polarized**
- **Electrostatics**
- **Grounding**
- **Induced**
- **Induction**
- **Insulator**
- **Semiconductor**
- **superconductor**

EQUATIONS:

$$F = k\frac{q_1 q_2}{d^2}$$

UNIT V: Electricity and Magnetism

Chapters 32-37

Chapter 32: Electrostatics

I. Electrical Forces and Charges (32.1)

A. **Electrostatics**- electricity at _____ (Involves electric charges, forces between them, and their behavior in materials)

B. Electrical forces

1. arise from _____ in atoms

2. Occur as _____ of **forces** acting on you at all times

a. _____ and _____ forces

b. This force attributed to property called _____

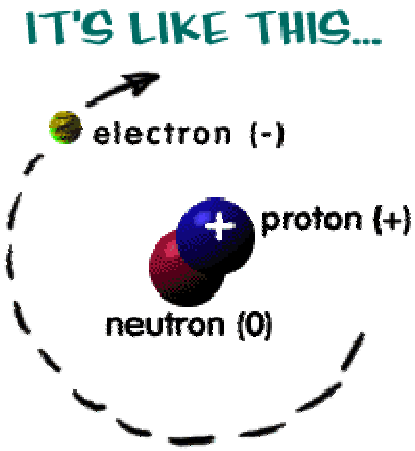
1). **Electrons**- _____ charge

2). **Protons**- _____ charge

3). **Neutrons**- _____ charge

3. Much _____ than gravitational force

C. **Atoms**



1. Every atom has **positively charged** _____ surrounded by **negatively charged electrons**

2. All **electrons** are **identical** (same _____ and _____ of negative charge)

3. **Nucleus** composed of _____ and _____.

a. all protons are _____

b. all neutrons _____

c. Proton has mass 2000 times _____ than electron

d. positive charge of proton _____ in **magnitude** to negative charge of electron.

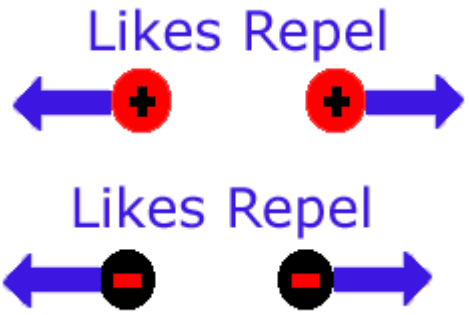
e. neutron has mass slightly greater than proton and has _____ **charge**

4. Atoms usually have as many electrons as protons,

so atom has a _____**net charge**

5. Fundamental rule at the base of all electrical phenomena is:

Like charges _____; opposite charges _____



II. Conservation of Charge (32.2)

A. Electrons and protons have electric charge

1. **Neutral atom**- electrons _____ protons (no net charge)

2. If electron removed atom no longer neutral- would have one extra proton and be positively charged

3. _____- a **charged atom**

a. **positive ion**- has net positive charge (it has lost one or more _____)

b. **negative ion**- has net negative charge (it has gained one or more extra _____)

B. Electrical charge

1. **Matter** made of _____

2. **imbalance** in numbers cause object to be _____ _____

C. Electrons

1. **Inner electrons** bound _____ to oppositely charged nucleus

2. **Outermost electrons**- _____ **bound** and can be easily _____.

3. Different materials require varying amounts of _____to tear an electron away from an atom

4. An object with unequal numbers of electrons and protons is **electrically charged** (either negatively or positively)

D. **Conservation of charge**

1. _____ **are neither created nor destroyed**

a. They are simply _____ from one material to another

2. _____ **is conserved** (cornerstone of physics along with **conservation of energy and momentum**)

III. Coulomb's Law (32.3)

A. Explains the electrical force between any two objects

1. Similar to _____ Law of Gravitation

2. Obeys _____**-square relationship** with **distance**

3. Discovered by French physicist **Charles Coulomb** (1736-1806)

B. **Coulomb's Law**- states that for **charged particles** or **objects** that are small compared to the distances between them, the **force** between the charges **varies directly** as the **product of the charges** and **inversely** as the **square of the distance** between them

d = distance between charged particles
q_1 = quantity of charge of one particle
q_2 = quantity of charge of other particle
k = proportionality constant

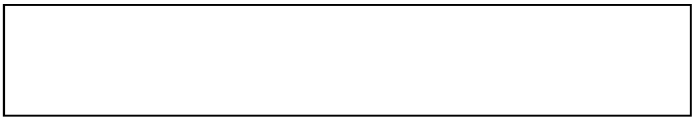
1. SI unit of charge is the _____ **(C)**

a. **One coulomb** = charge of 6.24 billion billion electrons (**6.24×10^{18} electrons**)

b. Amount of charge that passes through common 1--W light bulb in about _____

2. **Proportionality constant** (**k**) in Coulomb's law is similar to **G** in Newton's law of gravitation.

a. Unlike (G) in gravitation equation, (**k**) is a very _____ **number**



b. Biggest difference between gravitation and electrical forces is that while **gravity only attracts**, **electrical forces may either** _____ **or** _____.

C. Electrical forces usually _____ **out**.

1. Weak _____ force (attractive only) is predominant force between astronomical bodies

2. **Atomic level**- explains the bonding of _____ to form _____

IV. Conductors and Insulators (32.4)

A. **Conductor**-materials that have more _____ bound outer electrons that can _____ in the material

1. **Metals** are **_____ conductors of** _____

2. Also <u>good</u> **conductors of** _____

B. **Insulator**- Materials whose _____ are not free to wander

1. Also **_____ conductors of heat**

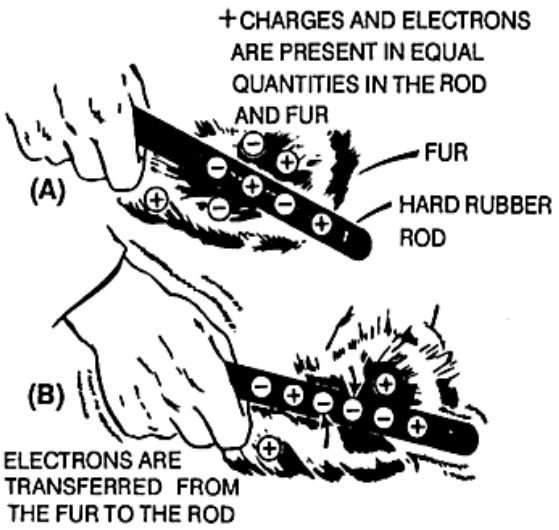
2. **Rubber** and **glass** good _____

C. **Semiconductors**- materials that can be made to behave as either conductor or insulator (thin layers of semi-conducting materials sandwiched together make up _____)

D. **Superconductors**- materials that acquire infinite _____ (At temperature near _____, certain metals become superconductors)

V. Charging by Friction and Contact (32.5)

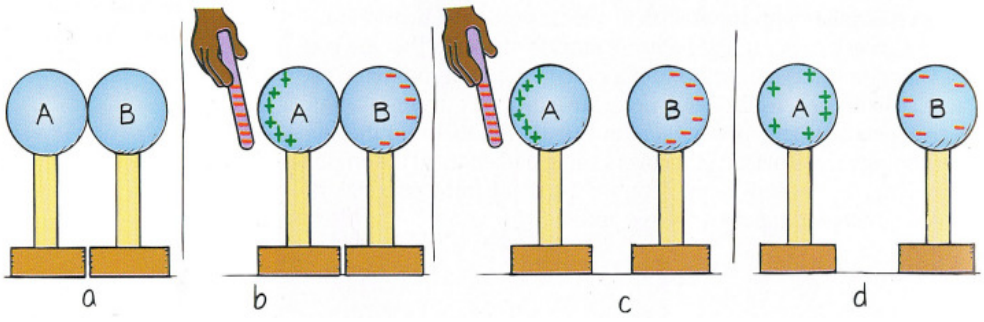
A. **Charging by Friction**- can _____ electrons when one material _____ against another



B. **Charging by Contact**- can transfer _____ by touching charged object to _____ object

VI. Charging by Induction (32.6)

A. **Electrons** are caused to _____ or _____ by the presence of a nearby charge (even w/o physical contact)

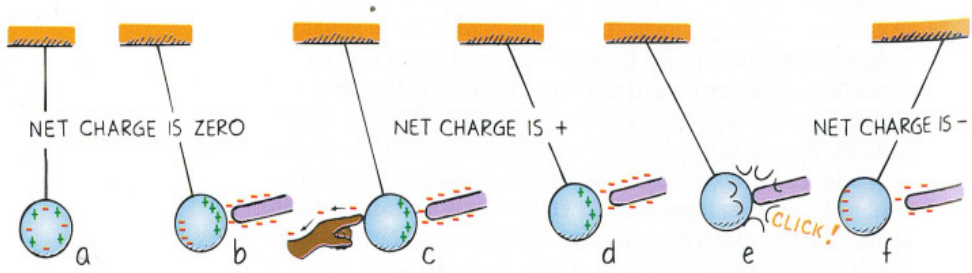


1. Charging by induction occurs during **thunderstorms**

2. Demonstrated by **Benjamin Franklins** kite experiment

3. Most lightning is an electrical discharge between oppositely charged parts of a _____.

B. An object can be charged when touched when the charges are _____ by induction.



C. _____- when we allow charges to move off (or onto) a conductor by touching it, it is common to say we are **grounding it.**

1. allow path to practically _____ reservoir for electric charge (the ground)

2. Important when we talk about electrical currents

3. **Lightning rod**- designed by Franklin to prevent large buildup of charge that would otherwise lead to a sudden _____ between cloud and building.

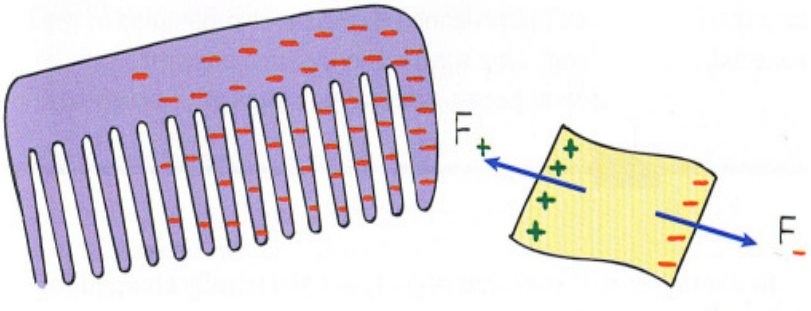
VII. Charge Polarization (32.7)

A. When charged rod brought near an insulator, there are no _____ electrons to migrate throughout the insulating material.

Instead there is a _____ of the positions of charges within the atoms and molecules.

1. One side is _____ to be slightly more **positive** or **negative** than the opposite side

2. The atom or molecule is said to be **electrically** _____.



3. Many molecules are electrically polarized (_____)