

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**- _____ (Involves electric charges, forces between them, and their behavior in materials)

B. Electrical forces

1. arise from _____ in atoms

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

a. **Attracting** and _____ forces

b. This force attributed to property called _____

1). _____ - negative charge

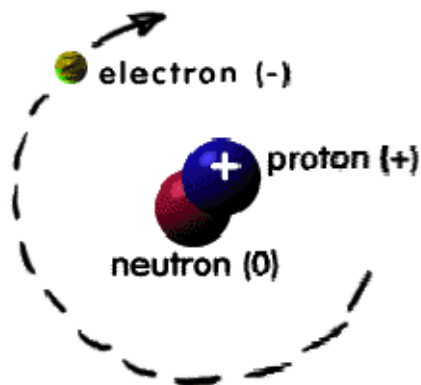
2). _____ - positive charge

3). _____ - neutral charge

3. Much _____ than gravitational force

C. Atoms

IT'S LIKE THIS...



1. Every atom has _____ **charged nucleus** surrounded by **negatively charged** _____

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

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

a. all protons are **identical**

b. all neutrons **identical**

c. Proton has mass 2000 times _____ than electron

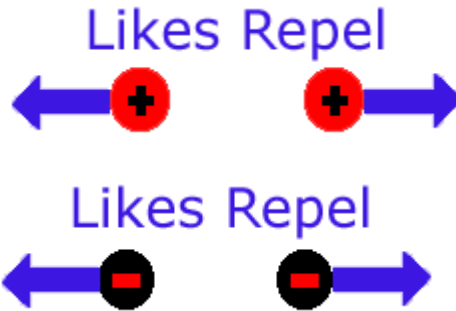
d. positive charge of proton _____ in **magnitude** to negative charge of electron.

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

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

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

B. Electrical charge

1. **Matter** is made up of _____.

2. _____ in numbers cause object to be **electrically charged**

C. Electrons

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

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

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

4. An object with unequal numbers of electrons and protons is **electrically charged**

D. Conservation of charge

1. **Electrons are neither _____ nor _____**

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 _____ between any two objects

1. Similar to Newton's Law of Gravitation

2. Obeys **inverse-_____relationship** with **distance**

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

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

Equation

d = distance between charged particles

q₁ = quantity of charge of one particle

q₂ = 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 (_____ **electrons**)

b. Amount of charge that passes through a 1 watt light bulb in about 1 second.

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

K =

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

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

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

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

2. _____ - explains the bonding of atoms to form molecules

IV. Conductors and Insulators (32.4)

A. _____ - materials that have more loosely bound outer electrons that can roam in the material

1. _____ are good **conductors of electricity**

2. Also good **conductors of** _____.

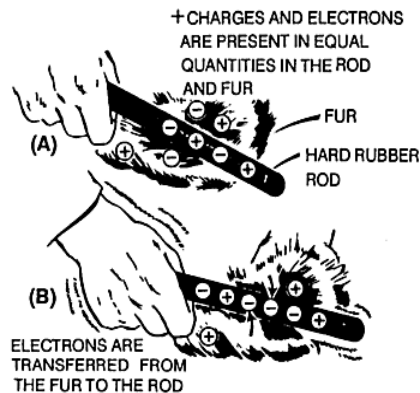
B. _____ - Materials whose electrons are not free to wander

1. Also poor **conductors of** _____

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

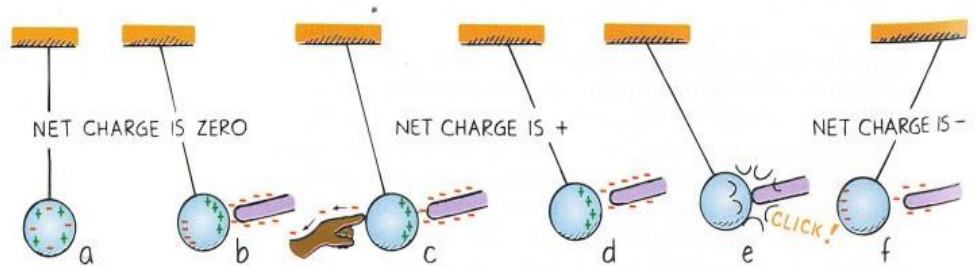
C. **Semi-conductors**- materials that can be made to behave as either conductor or insulator (thin layers of semi- conducting materials sandwiched together make up _____)

_____ - materials that acquire infinit conductivity (At temperature near absolute zero, certain metals become superconductors)



V. Charging by Friction and Contact (32.5)

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



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

VI. Charging by Induction (32.6)

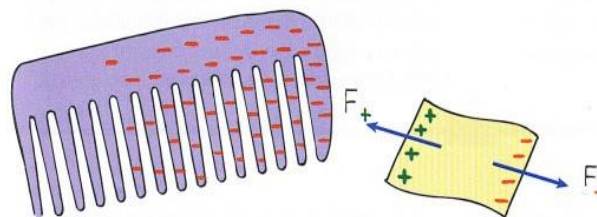
A. _____ are caused to gather or disperse by the presence of a nearby charge (even without physical contact)

1. Charging by induction occurs during _____

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

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

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



_____ - when we allow charges to move off conductor by touching it, it is common to say we are **grounding it**.

1. allow path to practically infinite reservoir for electric charge (the ground)
2. Important when we talk about electrical currents
3. _____ - designed by Franklin to prevent large buildup of charge that would otherwise lead to a sudden discharge between the cloud and building.

VII. Charge Polarization (32.7)

A. When charged rod brought near an insulator, there are no free 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 _____ or _____ than the opposite side
2. The atom or molecule is said to be **electrically** _____.

