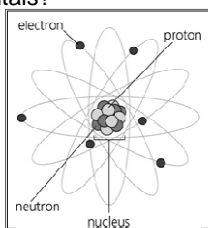


Electrostatics

Chem 101

- What makes up an atom's nucleus?
 - Protons & Neutrons
- What part of the atom travels around the outside of the nucleus in orbitals?
 - Electrons
- What is the charge of the parts of the atom?
 - Proton = positive charge
 - Neutron = no charge
 - Electron = negative charge



Electrostatics

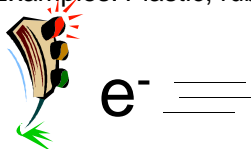
- Study of electrical charges that can be collected and held in one place
- Elementary charge
 - the magnitude of the electrical charge carried by one proton or one electron ($1.60 \times 10^{-19}\text{C}$)
- Coulomb
 - SI unit of charge
 - unit of charge for 6.25×10^{18} electrons

Sample Problem

- There are 500 electrons taken off of the surface of a metal sphere. What is the charge of the sphere?
- A balloon is rubbed on a sweater, giving it a charge of $-20 \mu\text{C}$. How many excess electrons are on the balloon?

Insulators

- Materials in which charges will not move through easily
- Valence electrons are tightly bound
- Examples: Plastic, rubber, glass, dry air



Conductors

- Materials in which charges are allowed to move through easily
- Valence electrons are loosely bound
- Electrons carry or conduct the charges through the material
- Examples: copper, aluminum, graphite



Electric Man!!



Conserving Charge

- Charges are not made, they are separated
- These charges can be transferred from one object to another
- The net charge in an isolated system remains constant

Separation of Charge

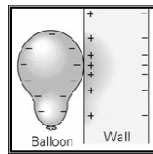
- There are four ways to separate or transfer the charges:
 - Friction
 - Conduction
 - Induction
 - Polarization

Separating Charges

- Friction
 - Addition of energy can separate the charges
 - Ex: rubbing a rubber rod with fur
 - rod becomes (-) charged, fur becomes (+) charged
 - Ex: rubbing a glass rod with silk
 - rod becomes (+) charged, silk becomes (-) charged

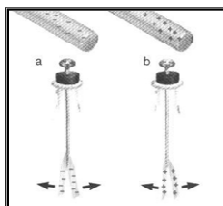
Separating Charges

- Polarization
 - Separating the charges within an object.
- Conduction
 - touching a neutral body with a charged body



Separating Charges

- Induction
 - causing electrons to move because of a charge placed close to an object (not touching)



Forces Caused By Charges

- Two types of charges: positive and negative
- Charges exert forces on other charges over a distance
- Like charges repel
- Opposite charges attract
- Charged objects are always attracted to neutral objects

Coulomb's Law

- Magnitude of the force that a tiny sphere with charge q_1 exerts on a second sphere with a charge of q_2 , separated by a distance, r , is

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

$$k = 9.0 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$$

Coulomb's Law

- Direction of Forces
 - Positive force symbolizes a repulsive force
 - Negative force symbolizes a attractive force
- Charged objects are always attracted to neutral objects

$$F \propto q \qquad F \propto \frac{1}{d^2}$$

Return to Honors Physics Notes
