

Atomic Structure

- The structure of atoms is important to Materials Engineers because it influences the way atoms are bonded together which in turn helps us to categorize the materials that they form.
- The atomic structure and bonding also allows us to formulate some general conclusions on the mechanical and physical properties of the material.

The Structure of an Atom

- **Nucleus:** Particle Mass $\sim 1.67 \times 10^{-24}$ g
 - **Proton:** Positive Charge ($+1.60 \times 10^{-19}$ C)
 - **Neutron:** Neutral Charge
- **Electron:** Mass $\sim 9.11 \times 10^{-28}$ g

Negatively Charged (-1.60×10^{-19} C)

A normal atom has equal numbers of protons and electrons.
The Atomic Number of an atom is the number of protons it has in its nucleus.

Atomic Mass

- The atomic mass of an element is the mass of a mole of the element (g/mol) or the weight of an atom times Avogadro's number ($N_A = 6.02 \times 10^{23} \text{ atoms/mole}$)
- An Atomic Mass Unit (AMU) is $1/12$ the mass of a carbon 12 atom.

Atomic Bonding

- **Metallic Bond** - sea of electrons
- **Covalent Bond** - sharing of electrons
- **Ionic Bond** - one atom giving up electrons to another atom
 - Cation - positive charge (the donor atom)
 - Anion - negative charge (the receptor atom)
- **Van der Waals Bond** - electrostatic attraction (secondary bond)

Binding Energy

The inter atomic spacing is governed by the balance of attractive and repulsive forces.

Some of the properties that can be related to these are Modulus of Elasticity and Coefficient of Thermal Expansion

