Prelude

Powers of Ten

- $10^0 = 1$
  $10^1 = 10$
  $10^2 = 100$
  $10^3 = 1000$
- $10^{-1} = 0.1$
- $10^{-2} = 0.01$
  $10^{-3} = 0.001$

Common prefixes:

- kilo – 10^3
- mega – 10^6
- centi – 10^{-2}
- milli – 10^{-3}
- micro – 10^{-6}
- nano – 10^{-9}

Units of length:

- nanometer 1/1,000,000,000 of a meter
- micrometer 1/1,000,000
- millimeter 1/1000 of a meter
- centimeter 1/100 of a meter
- meter
- kilometer 1000 meters

Common quantities in physics and their mks units

force – Newtons
displacement - meters
velocity – meters/sec
acceleration – meters/sec^2
energy – joules
mass - kilogram

Elements/Atoms/Matter/Energy

- The universe is made up of matter consisting of elements, atoms, and subatomic particles. Atoms consist of electrons, protons and neutrons. There are smaller particles within atoms but we will start here. A hydrogen atom is less than 10^{-10} meters across and most of that is empty space (sub atomic particles are much smaller). Matter and energy are equivalent (they are two forms of the same thing!). It is possible to convert matter to energy and vice versa. Einstein's equation $E = mc^2$ gives a mathematical relationship between matter and energy. When sub atomic particles combine they form atoms. Atoms form elements. Elements combine to form molecules and compounds.

The Electromagnetic Spectrum

- Energy has many forms: the potential and kinetic energy of bodies, thermal energy, and electromagnetic energy. Often one form of energy is related to another. The electromagnetic spectrum consists of E/M waves from very small (gamma rays – 10^{-14} meters wavelength) to very large (radio waves - > 1 kilometer wavelength).

The Four Fundamental Forces

- Gravity
- Coulomb
- Strong Nuclear
- Weak Nuclear

Problem Solving Strategies

- translation
- explicit/implied information
- what are the physics of the problem
- use appropriate math
- dimensional analysis/unit analysis
- does the answer make sense?