Homework # 1; due Thursday, Jan. 31

Reading: Chapter 1 of Kittel's *Introduction to Solid State Physics*; this assignment will also help you review some of the things that each physicist needs to know "fluently."

1. Please estimate the number of atoms in yourself. How about the number of molecules?

2. What is the highest-density element, and what is its density? Compare this to the density of water. (Please make a note of and remember the density of water in g/cm^3). How many moles of this dense element are contained in 1 cm^3 of it? How many protons, neutrons, and electrons are in this volume of the material? What is the mass of one atom in grams and eV/c^2 (where c is the speed of light)?

3. What is the total weight of the air in the room where you are working on this homework assignment? What is the *number density* of the air (in molecules per cm^3)? What is the ratio of this number density to that of liquid water?

4. What is the number density of water ice? Compare it to the number density of liquid water. Is this a usual relation between solid and liquid densities? Estimate the distance between adjacent oxygen atoms in a water crystal; express it in cm, nm, and angstroms (Å).

5.
    a. What is the energy of a photon (in eV) when its wavelength is 1 Å?
    b. What is the kinetic energy of a neutron when its De Broglie wavelength is 1 Å? What is the neutron's speed?

6. Referring to the *Miller-index* notation, show that, for a cubic lattice, a [*hkl*] vector is perpendicular to the (*hkl*) plane.