Assignment 2: Due Thursday Jan 28

1. Explain *a, n* and *d* glides in 3D crystals using sketches.
2. Cubic cells always have a -3 or 3 in the space group label. What is the -3 symmetry element in a cube.
3. Sketch the following structures as sections along different heights: (a) *hcp* along the *c* direction and *fcc* along the body diagonal.
4. What kind of a unit cell is obtained if one of the axis (the *c*) of an close packed *fcc* cell is elongated to give a tetragonal cell. Try and guess the space group. Remember to look for more compact unit cells in the *a-b* plane as well.
5. Use the Java program Escher (linked on the website) to sketch 2-D plane patterns using a **single** little filled square as a motif, in the plane groups (a) pg, p2gg, c2mm, p3m1 and p6mm. Also distinguish p3m1 from p31m.
6. Color could represent a physical property such as spin (black = spin up and white = spin down). Can you sketch an object with 3′ symmetry. What does this say about spins at the corners of a triangle ?
7. Calculate the efficiency of packing in the diamond structure. Remember that there are 8 atoms in the cell, and that the atom at (0,0,0) touches the atom at (1/4,1/4,1/4).
8. Sketch the following structure in sections, and in "3D", and determine the coordination of each atom (how may neighbors, and at what distance):
   Cu_3Au, *Pm-3m*, *a*= 3.74 Å, Cu at (½, ½,0) and Au at (0,0,0)
9. Use VESTA to draw all the elemental structures whose data have been presented to you (from α-Po ...). make the pictures pretty !