Assignment 2: Due Thursday Feb 2nd

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 axes (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. In addition to normal symmetry operations, Shubnikov has described elements of color symmetry. For example, the mirror m′ would take a black object and reflect it to a white one as shown below. Sketch 2D objects with the following symmetries: (i) 4mm (ii) 4′m′m′ (iii) 2m′m′ (iv) 6′.

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):
   Cu₃Au, 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 …)