Quiz 2

Thursday, January 27, 2011

Your name:

For each of the following sentence (or the last sentence if an item consists of multiple sentences), mark it as true or false. If false, make a necessary change, or changes, to the sentence to make it correct.

1. The reciprocal unit cell increases in volume if the real space unit cell is made to increase in volume.

2. The neutrons used in a diffraction experiment on a typical crystal can be tuned to the required energy by thermally exciting them to several times the room temperature.

3. For a diffraction experiment on crystals using photons, UV light (with energy on the order of 10 or 100 eV) will do.

4. Miller indices of a lattice plane are the indices of the smallest non-zero reciprocal lattice vector perpendicular to the lattice plane.

5. You have two samples of an identical nano-crystal. They are perfectly uniform crystals, and identical in all aspects except that the first sample (sample 1) consists of 100 atoms (sample 1) and the second sample (sample 2) consists of 1000 atoms. Each sample is put in a diffraction machine in turn, where the light hits the entire sample and diffracts. The diffracted pattern is recorded as the intensity of the diffracted light plotted as a function of the wave vector change ($\Delta\vec{k}$) of the light. For a given Bragg condition $\Delta\vec{k} = \vec{G}$, the diffraction peak observed for sample 2 is 10 times as high as for sample 1.

6. Whether you have a macroscopic piece of a crystal consisting of a very large number

($\sim$ Avogadro's number) of atoms, or a nano-crystal consisting of a much smaller number ($\sim$ 1000, say) of atoms, the diffraction occurs only when the Bragg condition $\Delta\vec{k} = \vec{G}$ is satisfied.

7. In a crystal, the volume of a primitive unit cell is a constant no matter how one chooses to define the shape of the primitive unit cell.

8. In a crystal, the volume of the primitive unit cell depends on what atoms the basis consists of.