**Solid State Stoichiometry**

A repeating building block, or **unit cell**, is used to represent extended structures since shifting a unit cell along its edges by the length of the edge will exactly replicate the extended structure.

In determining stoichiometry, only the fraction of an atom within the unit cell counts. In three-dimensions atoms can be shared between unit cells on corners, on edges and on faces of the unit cell. Atoms on corners are shared by eight unit cells, atoms on edges are shared by four cells and atoms on faces are shared by two cells. Therefore only one-eighth of a corner atom, one-quarter of an edge atom and one-half of an atom on a face is in any one unit cell. The total number of atoms in a unit cell is given by:

 +  +  + 

A useful method for representing three-dimensional structures on paper uses **layer sequences** and involves imagining planes slicing through the unit cell parallel to a cell face and bisecting atoms in the cell. When the planes are drawn on paper, the bisected atoms appear as circles. The planes are identified by the fraction of the repeat distance.

 

The body-centered cubic unit cell and its layer sequence.

**Assignment:**

For five solid state structures determine the empirical formula. Show your work by indicating how many spheres of each type have their centers located inside the unit cell, on faces, on edges, or on corners. (A given sphere only has one location: inside, face, edge, and corner locations are mutually exclusive.)