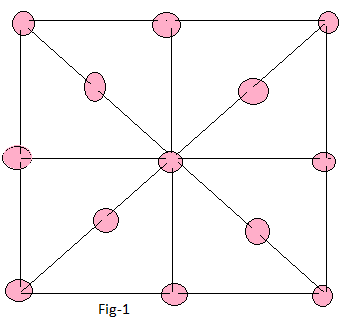
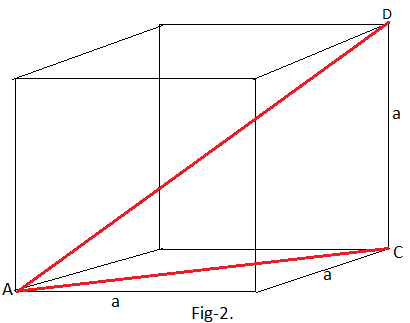
VI\_8: **Diamond structure:**

The diamond structure is a combination of two inter-penetrating face-centered-cubic sub-lattices. One sub-lattice has its origin at the point (0, 0, 0), and the other at a point one quarter of the way along the body diagonal (at the point a/4, a/4, a/4). The projection of atoms in the cubic cell of diamond cubic structure is shown in fig-1.

Since each atom has only four nearest neighbors, its co-ordination number is 4, and thus the diamond cubic structure is loosely packed.

There are eight corner atoms along with six face-centered atoms and four more atoms are presented in the unit cell. Again, each face-centered atom is shared by two unit cells and the corner atom is shared

by eight adjacent unit cells. Hence, the number of atoms per unit cell

= ( x 6) + ( x 8 ) + 4 = 8.

If ‘a’ be the cube edge,

AC2 = a2 + a2 = 2 a2

AD2 = AC2 + CD2 = 2 a2  + a2 = 3 a2

Or, AD ( Body diagonal) = a.

There are three full spheres and two half spheres along the diagonal. If ‘r’ is the radius of the spherical atom,

AD = r + 3(2r) + r = 8r

Or, 8r = a.

Or, a =

Volume of the unit cell V = a3 = ( )3

Volume of all atoms in the unit cell ѵ = 8 x r3

So, packing fraction = = (32 r3/3)/( 8r/)3



= 0.34

Or, PF = 34%

Thus, the structure is loosely packed. The unit cell of diamond is similar to that of germanium and silicon.

