4/10/20

M.Sc. III semester

PHY- 301 [Condensed matter Physics - I]

UNIT- I

Crystals :-

The word crystal comes from the Greek word "krustallos" used to describe transparent crystal of quartz. Earlier crystals were used for decorative purposes. However, with the development of the science of crystallography, all sides with definite geometrical forms were grouped as crystalline solids.

A crystal can be defined as a homogenous solid with definite chemical composition bounded by formed plane faces having definite geometrical shape. These faces show a regularity of arrangement called "symmetry". A crystal is formed by the regular repetition of atoms or molecules known as space group.

All materials are composed of atoms & molecules. The fact that distinguishes crystals from non-crystals is the way that atoms are stacked in a regular manner in crystals. In crystals the atomic array is

periodic, i.e. a representative unit is repeated at regular intervals along any and all directions in the crystal. In non-crystals the same atomic groups are arranged more randomly.

Single and polycrystalline Crystals:-

In single crystals the periodicity extends throughout the material while in polycrystaline crystal, the periodicity does not extend throughout the crystal but is interrupted at grain boundaries

Crystal Lattice:-

In order to understend the atomic structure of a crystal, it is necessary to find out a way of describing the periodicity of the crystal structure. This can easily be achieved by developing the concept of lattice. As we know that the crystal structure is built by repetition of the repeating units in three dimensions, a lattice can be constructed by replacing each repeat unit by a lattice point. It would

Construct a grid like structure in space, where each lattice point has the same environment in the same orientation, this can be completely specified by these three non-coplanner & translational vectors of length a, b and c And three translational dirns x, y, z as crystallographic axis with any lattice point as origin.

So mathematically a lattice extends infinitely in space, and reffering one of the lattice point as origin, any other lattice point can be reached by operation

$$T = n_1 a + n_2 b + n_3 c \quad \text{——} (1)$$

where

n_1, n_2 & n_3 are arbitrary integers

$n_1, n_2, n_3 = 0, \pm 1, \pm 2, \pm 3, \text{- - -}$

The set of points T defined by (1) for all n_1, n_2 & n_3 defines a lattice