Brainbox learn easy

Unit 1

The Solid State

Crystal lattices and unit cells:

Space lattice (or) Crystal lattice:

A regular three dimensional arrangement of points in space is called Space lattice (or) Crystal lattice.

- There are 14 possible three dimensional particle is known as Lattice point.

Unit cell:

The smallest portion of crystal lattice which when repeated in different directions, gives entire lattice.

A unit cell is characterised by,

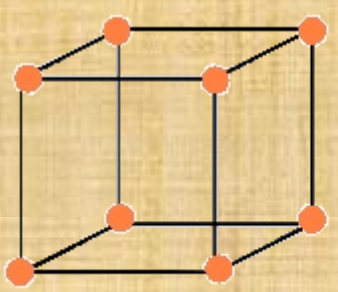
(i) Dimensions along three edge a, b, c. When may or may not be perpendicular.

(ii) Angles between the edges α, β & γ.

- Unit cells are broadly divided into two categories,

I) Primitive unit cell:

The particle (or points) are located only at the corners are called primitive (or) simple unit cell.



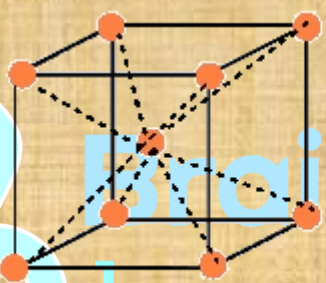
Primitive Unit Cell

II) Non primitive unit cell:

In this type of unit cell, particles (or points) are present not only at the corners but also some other positions. These are three types.

a) Body centred unit cell:

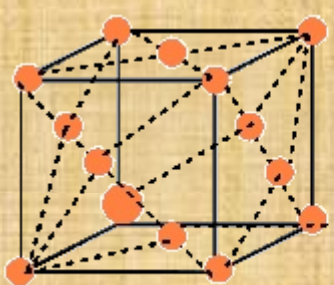
In this type of unit cell, particles are located at the corners and also at the centre with in the body.



Body Centered Unit Cell

b) Face centred unit cell:

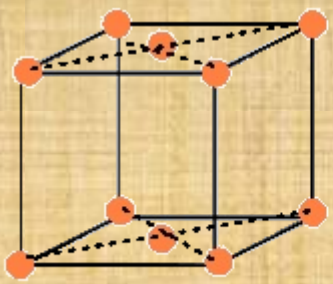
In this type of unit cell, particles are located at the corner and also in the centre of each face.



Face Centered Unit Cell

a) End face centred unit cell:

In this type of unit cell, particles are located at the corners and also at the centre of any two opposite faces.



End Centered Unit Cell

Effective number of atoms in a unit cell:

- A point that lies at the corner of a unit cell is shared among 8 unit cells and therefore only one – eighth of each such point lies with in the given unit cell. Contribution is 1/8.
- A point along the edge is shared by four unit cell and only one – fourth of it lies within only one unit cell. Contribution is1/4.
- A face centered point is shared by two unit cell and only one – half of it lies within the given unit cell. Contribution is1/2.
- A body centred point lies entirely within the unit cell and contributes one complete point to the unit cell. Contribution is 1.

Ex.

1. Simple cubic structure: No. of atoms per unit cell = 8 x 1/8 = 1 atom

2. Body centred cubic structure: No. of atoms per unit cell = (8 x 1/8) + 1 = 2 atoms

3. Face centred cubic structure: No. of atoms per unit cell = (8 x 1/8) + (6 x 1/2) = 4 atoms

4. End centred cubic structure: No. of atoms per unit cell = (8 x 1/8) + (2 x 1/2) = 2 atoms