Lecture-22

B.Sc (Chem. Hons) III

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Crystal lattice and Unit cell

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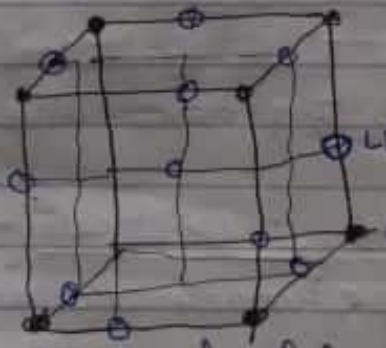
Crystal lattice

Crystal lattice is a three dimensional representation of atoms and molecules arranged in a specific Pattern. In other words a crystal lattice can be defined as a geometrical arrangement of constituent particles of matter (atoms, ions or molecules) as points in space there are total 14 possible three-dimensional lattices. Crystal lattices are also known as Bravais Lattices.



Example of Crystal lattice

Characteristics of Crystal lattices →

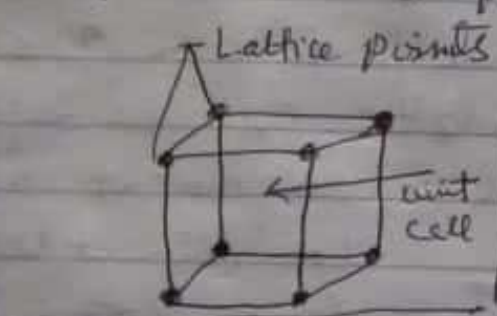
The following characteristics are depicted by Bravais lattices:

1) Each point in a lattice represents a lattice site or we can say Lattice point

2) Each point denotes a particular type of constituent particles of matter be it an atom, molecule or an ion.

3) By joining the lattices points inside the lattice the can define geometry of the lattice

Unit Cell



The smallest possible portion or part of of the crystal lattice which repeats itself in different directions of the lattice is called the Unit cell. Many unit cells combine to geometrically form the crystal lattice.

Characteristics of Unit cell →

The following characteristics define a unit cell:-

1) A unit cell has three edges a, b and c, and three angles α, β and γ between the respective edges.

2) The a, b and c may or may not be mutually perpendicular.

3) The angle between edge b and c is α, a and c is β and between a and b is γ.

Unit cells are of two types

(1) Primitive unit cells
(2) Centred unit cells.

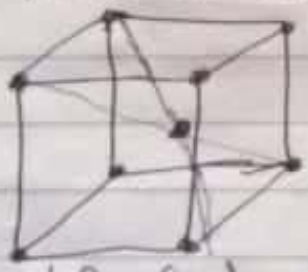
Primitive unit cell

The unit cell in which the constituent particles (atoms, ions or molecules) are located only on the corners of the lattice is called a primitive unit cell.

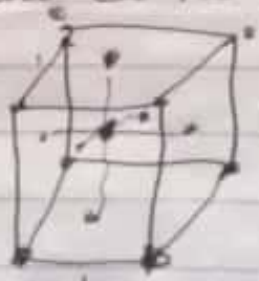
Primitive (P) unit cell

Centered Unit cells

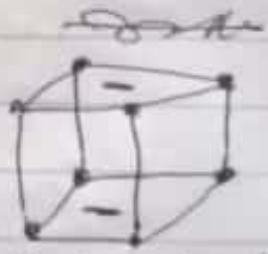
The unit cell in which the constituent particles (atoms, ions or molecules) are located on the corners as well as



I (Body)



F (Face)



End centred

other positions of the lattice is known as centred unit cells. A centred unit cell is further divided into three types.

1) Body Centred unit cells (2) Face Centred unit cells (3) End Centred unit cells

Body Centred unit cells:-
The unit cell which contains one constituent particle (atom, molecule or ion) at its body centre and other constituent particles are located on the corners is called Body Centred Unit cells.
Face Centred Unit cells:- The unit cell which contains constituent particles on each face of the unit cell and other constituent particles on the corner is called Face Centred Unit cell.
End Centred Unit cells:- In an end centred unit cell one ~~Centre~~ constituent particle is present at the centre of opposite faces besides the one located on the corners.