What is a Unit Cell?

> The smallest repeating unit of the crystal lattice is the unit cell, the building block of a crystal.

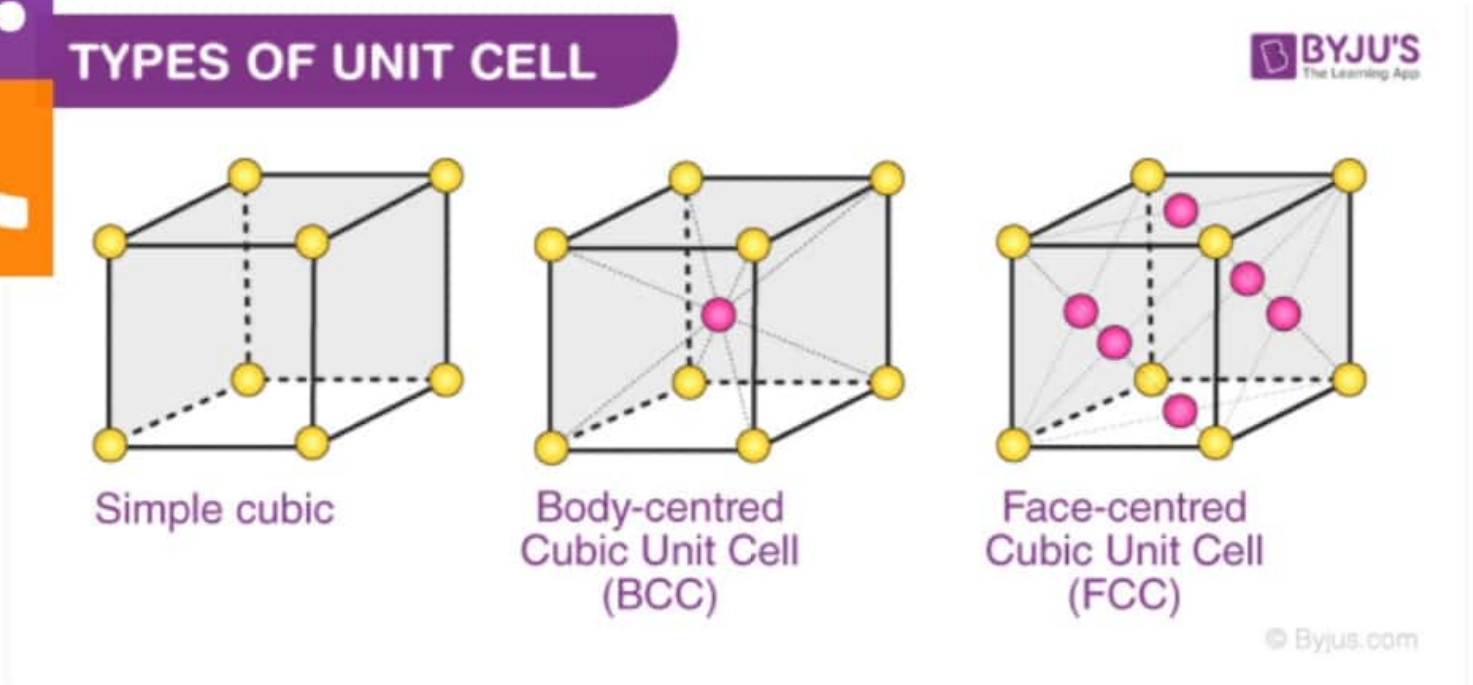
The unit cells which are all identical are defined in such a way that they fill space without overlapping. The 3D arrangement of atoms, molecules or ions inside a crystal is called a ***crystal lattice.*** It is made up of numerous unit cells. One of the three constituent particles takes up every lattice point.

A unit cell can either be ***primitive cubic, body-centred cubic (BCC) or face-centred cubic (FCC).*** In this section, we will discuss the three types of unit cell in detail.

Types of Unit Cell

Numerous unit cells together make a crystal lattice. Constituent particles like atoms, molecules are also present. Each lattice point is occupied by one such particle.

1. ***Primitive Cubic Unit Cell***
2. ***Body-centered Cubic Unit Cell***
3. ***Face centered cubic unit cell***



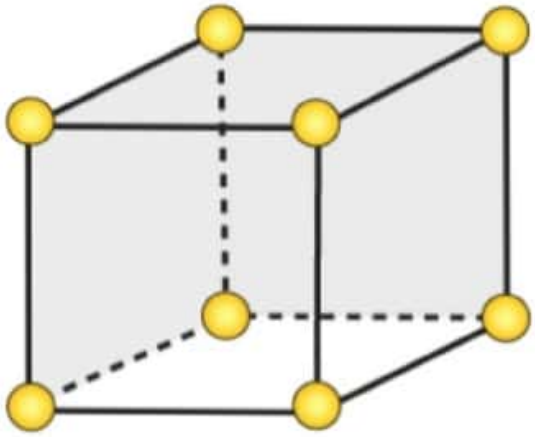
1. Primitive Cubic Unit Cell

In the primitive cubic unit cell, the atoms are present only at the corners. Every atom at the corner is shared among 8 adjacent unit cells. There are 4 unit cells in the same layer and 4 in the upper (or lower) layer. Therefore, a particular unit cell has the only $1/8^{th}$ of an atom. Each small sphere in the following figure represents the centre of a particle that occupies that particular position and not its size. This structure is known as an *open structure*.

1. The atoms in the **primitive cubic unit cell** are present only at the corners
2. Every atom at the corner is shared among eight adjacent unit cells

4. Four unit cell in the upper/lower layer
5. Therefore, a particular unit cell has the only 18th of an atom
6. Each small sphere in the following figure represents the centre of a particle which occupies that particular position and not its size

elow is an open structure



Simple cubic unit cell

In each cubic unit cell, there are 8 atoms at the corners. Therefore, the total number of atoms in one unit cell is

$8 \times 1/8 =$ **1 atom**.