



SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)
SNS Kalvi Nagar, Saravanampatti Post
Coimbatore - 641 035



Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Accredited by NBA & accredited by NAAC with 'A+' Grade, Recognized by UGC


Crystal Structures

Simple Cubic Structure
There is one atom at each corner of the unit cell. These atoms touch each other along cube edge.

1. No. of atoms per unit cell
Share of each unit cell = $\frac{1}{8}$ of each corner atom.
Total no of atoms in one unit cell = $\frac{1}{8} \times 8 = 1$

2. C.N.
It has 8 corner atoms. Let us consider one of the corner atoms (x). There are 4 nearest neighbouring atoms to this particular atom 'x' which are in a horizontal plane & 2 more atoms in vertical plane.
Hence, the co-ordination no. for SC = 6.

3. Atomic radius
 $a = 2r$
 $r = \frac{a}{2}$



4. Packing factor
No. of atoms per unit cell = 1.
Volume of one atom $V = \frac{4}{3} \pi r^3$ ~~$r = \frac{a}{2}$~~ $2r = a$
Total volume of the unit cell = a^3
P.F. = $\frac{V}{V_{cell}}$
 $\Rightarrow \frac{\frac{4}{3} \pi r^3}{a^3} = \frac{\frac{4}{3} \pi r^3}{8r^3} \Rightarrow \frac{\pi}{6} \Rightarrow \frac{3.14}{6}$
P.F. = 52%
52 \rightarrow occupied by the atoms
48 \rightarrow volume is vacant
eg: Polonium



SNS COLLEGE OF TECHNOLOGY

(AN AUTONOMOUS INSTITUTION)
SNS Kalvi Nagar, Saravanampatti Post
Coimbatore - 641 035



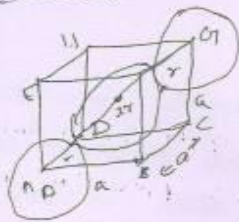
Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai
Accredited by NBA & accredited by NAAC with 'A+' Grade, Recognized by UGC

Body-centred Cubic Structures

1) No. of atoms per unit cell: $\frac{1}{8} \times 8 = 1 \Rightarrow 1 + 1 = 2$

2) CN \Rightarrow The corner atoms do not touch each other. But all the eight corner atoms of the unit cell touch the body centred atom along the body diagonal.

3) atomic radius:



ΔABC
 $AC^2 = AB^2 + BC^2$
 $a^2 + a^2 = 2a^2$
 $AG = \sqrt{2}a$
 on eq. on both sides, we get
 $(AG)^2 = (4r)^2$
 $\Delta ACG = \Delta AGC = AC^2 + CG^2$
 $(4r)^2 = 2a^2 + a^2 = 3a^2 \Rightarrow 4^2 r^2 = 3a^2$
 $r^2 = \frac{3a^2}{4^2} \Rightarrow r = \frac{\sqrt{3}a}{4}$

4) P.F: No. of atoms per unit cell: 2
 $V = 2 \times \frac{4}{3} \pi r^3$; $a = \frac{4r}{\sqrt{3}}$

Volume of the unit cell $V = a^3$ P.F: $\frac{V'}{V}$

P.F: $\frac{2 \times \frac{4}{3} \pi r^3}{a^3}$
 $= \frac{2 \times \frac{4}{3} \pi r^3}{\left(\frac{4r}{\sqrt{3}}\right)^3} \Rightarrow \frac{\frac{8}{3} \pi r^3}{\frac{64 \times r^3}{8 \sqrt{3}}} = \frac{\pi \sqrt{3}}{8}$
 $= \underline{\underline{68\%}}$