



# 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

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 =  $\frac{1}{8} \times 8 = 1$

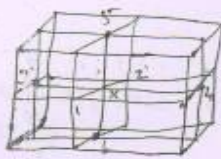
∴ Coordination  
It has 8 corner atoms. Let us consider one of the corner atoms (x).  
There are 4 nearest neighbouring atoms to this particular atom 'x' which are in a horizontal plane & 2 more atoms in vertical plane.  
Hence, the co-ordination no. for SCC = 6.

∴ Atomic radius  
 $2r = a$   
 $r = \frac{a}{2}$

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 =  $a^3$   
 $P.F. = \frac{V}{V}$   
 $\Rightarrow \frac{\frac{4}{3} \pi r^3}{a^3} = \frac{\frac{4}{3} \pi r^3}{8r^3} \Rightarrow \frac{\pi}{6} \Rightarrow \frac{3.14}{6}$   

P.F: 52%

  
52 → occupied by the atoms  
48 → volume is vacant  
eg: Polonium





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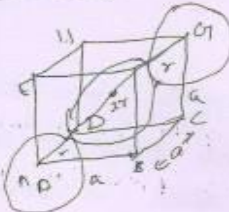
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Body - centered Cubic Structure

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 centered atom along the body diagonal.

3) atomic radius:



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

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 =  $\frac{2 \times \frac{4}{3} \pi r^3}{a^3}$

$= \frac{2 \times \frac{4}{3} \pi r^3}{\left(\frac{4r}{\sqrt{3}}\right)^3} \Rightarrow \frac{\frac{8}{3} \pi r^3}{\frac{64 r^3}{\sqrt{3}^3}} = \frac{\pi \sqrt{3}}{8}$

$= \underline{\underline{68\%}}$