A.P.F. = 0.52 or 52%

Physical meaning of this is out of 100% volume 52% is covered by atoms and 48% is empty space.

(X) Packing :- Simple cubic crystal is loosed packed structure.

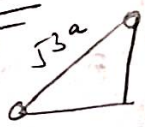
~~For any loose packed crystal~~ loose packed

For any loose packed crystal,

Coordinate no. < 12 and A.P.F. < 74%

(XI) Example :- Polonium

In S.C.



$2r + r_{max} = \sqrt{3}a$

$r_{max} = \frac{\sqrt{3}}{2}a - r$

$r_{max} = (\sqrt{3}-1)r$

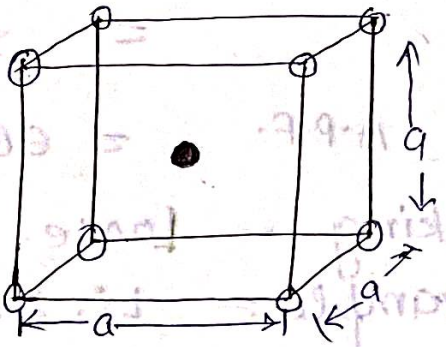
void

* Body - Centered Cubic (bcc) :→

(i) No of atom permit cell

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

$= 1 + 1 = 2$



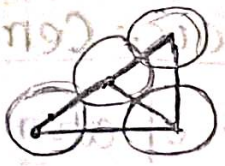
(ii) No. of nearest neighbour or co-ordination number = 8

* The empty space b/w two or more atom is know void

(iii) Nearest neighbour distance :⇒

$r + 2r + r = \sqrt{3}a$.

$\Rightarrow \boxed{4r = \sqrt{3}a}$



(IV) No. of second nearest neighbour :- 8

* Body centered atom of each faces of the cube is second nearest neighbour

(V) Second neighbour distance is a, larger than first nearest neighbour.

(VI) Volume of unit cell. a^3.

∵ lattice point – 2
atom – 2.

(VII) Volume of primitive unit volume – $a^3/2$.

So no. density is $2/a^3$. ⇒ No. of atom per unit volume.

(IX) Atomic Packing fraction :–

⇒ ~~A.P.F. = Volume of atom in unit cell / volume of unit cell~~

$$A.P.F. = \frac{\text{Vol. of atom in the unit cell}}{\text{volume of unit cell.}}$$

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

$$= \frac{\sqrt{3}\pi}{8} = 0.68$$

A.P.F. = 68%

(X) Packing – Loose.

(XI) Example :– Li, Na, K etc.

* Face-Centred Cubic (fcc)

(I) No. of atom per unit cell

$= \frac{1}{8} \times 8 + \frac{1}{2} \times 6$

$= 1 + 3 = 4.$