$$K\Phi_1 = M i_1$$

$$M = \frac{K\Phi_1}{i_1}$$

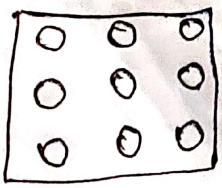
26-11-12

Structure of matter

1. States of matter
2. Classification of solid material — Crystalin
   Non Cry
   Amorpho

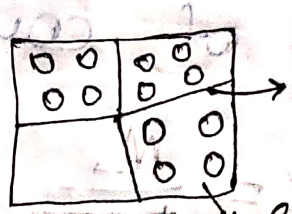
Crystaline

Single cryst.



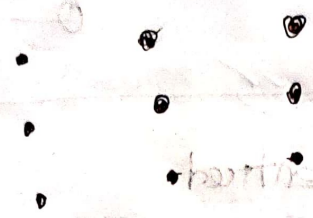
Same periodicity and regularity in all

Polycrystalline



Atomic arrangement:

1. ~~Unit~~ unit cell



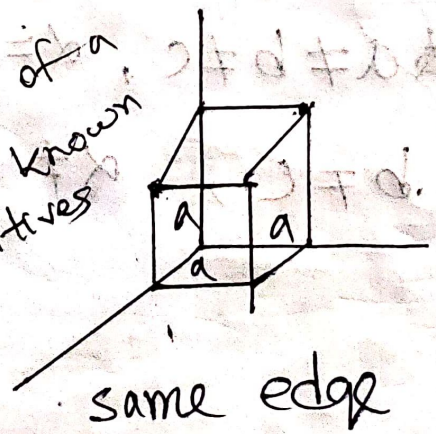
periodic

* Lattice → regular and periodic arrangement of points in three dimention.

* Basis → atoms or group of atom at every lattice point

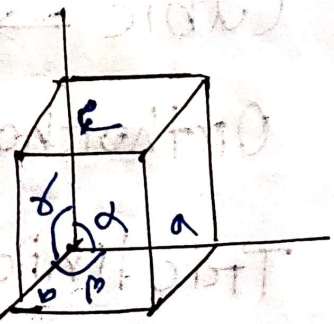
Lattice + basis = crystal structure

* unit cell → smallest volume whose repetitio construct entire structure is called unit cell.



The dimention of a unit cell is known as premitives

same edge

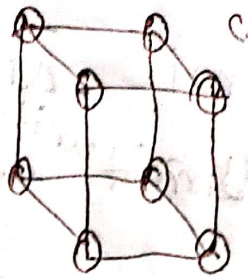


lattice parameters

a, b, c → Premiti

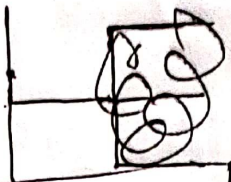
α, β, γ → Interfacia angles

1. Premitive unit cell →



Contain one lattice point

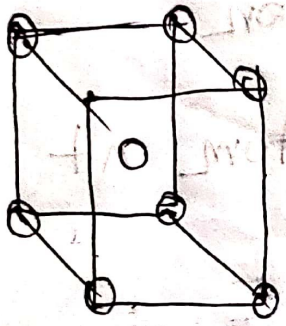
2. Non- " " "



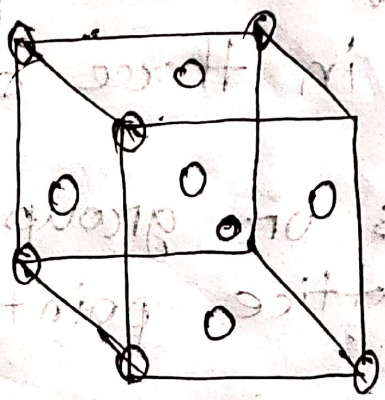
Body centres

Face centred

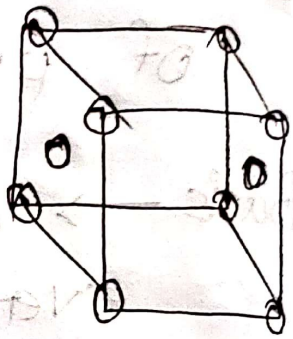
End/base centred



(I)



(F)



(A)

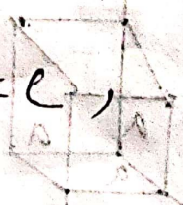
contain additional ~~unit cell~~ ~~lattice~~ lattice point either on a face of the unit cell or within the unit cell.

Seven crystal str. based on a, b, c & α, β, γ:

P, I, F) Cubic → $a=b=c$, $\alpha=\beta=\gamma=90°$

P, I, F, A) Orthorhombic → $a\neq b\neq c$, $\alpha=\beta=\gamma=90°$

P iii) Triclinic → $a\neq b\neq c$, $\alpha\neq\beta\neq\gamma$



P, A iv) Monoclinic

P, I v) Tetragonal

P VI) Hexagonal

P (VII) Trigonal

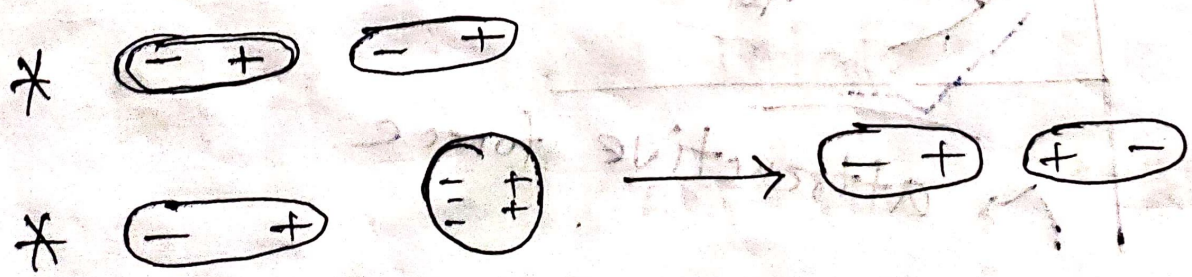
↓ 14 Bayes' lattice

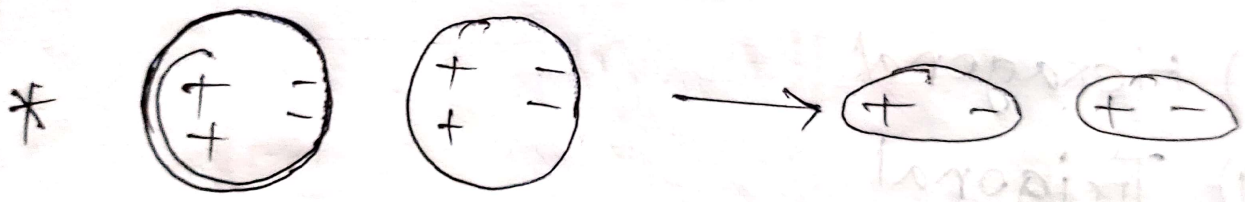
Different types of bond:

* Metallic
* Van der waals
* Covalent
* ionic
* Hydrogen

* Van der waals: is caused betn two nearby atoms by polerizat ion.

1. Permanent dipole – permanent dipole
2. Permanent dipole – induced dipole
3. induce



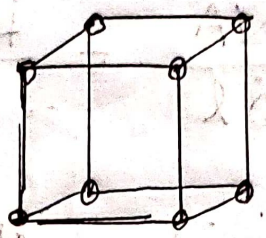


Packing Fraction

28-10-19

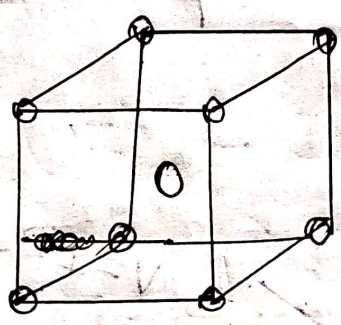
Packing fraction:

(1) Simple cubic (SC):



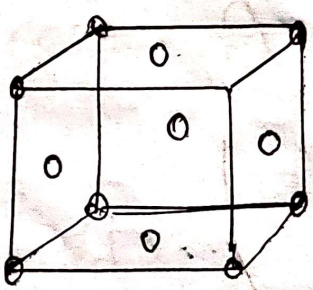
Atom are arranged in corner position

Number of atom $= \frac{1}{8} \times 8 = 1$



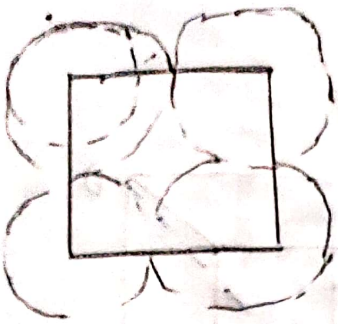
body centered cubic

no of atom $= \frac{1}{8} \times 8 + 1 = 2$



face centered cubic

no. of atom $= \frac{1}{8} \times 8 + 6\frac{1}{2} = 4$



$a = 2r$

$r = \frac{a}{2}$

a = cubic edge

r = radius of atom.

$$\text{Packing fraction} = \frac{\text{Vol. occupied by all atoms in a struct}}{\text{Vol. of the structure.}}$$

$$P = \frac{v}{V}$$

* Simple cubic:

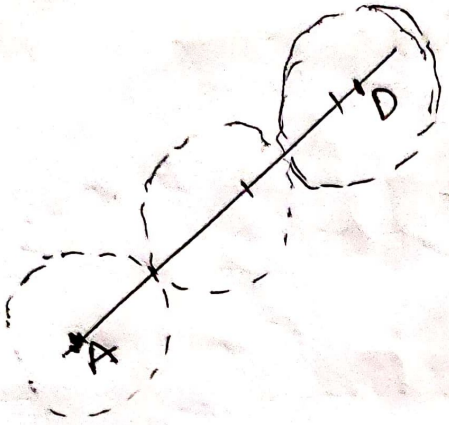
Vol. of one atom $= \frac{4}{3}\pi r^3$

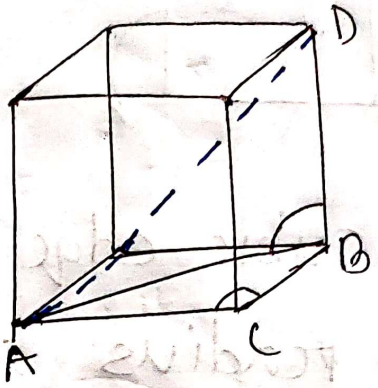
" " the structure $= a^3$

$$\therefore P = \frac{\frac{4}{3}\pi r^3}{a^3} = \frac{\frac{4}{3}\pi\left(\frac{a}{2}\right)^3}{a^3} = \frac{\pi}{6} = 0.52$$

ফাকা অংশ = 48%

* Body centered cubic:





$AD = 4r$

$$AD^2 = AB^2 + BD^2 = AC^2 + BC^2 + BD^2$$

$$\Rightarrow (4r)^2 = 3a^2$$

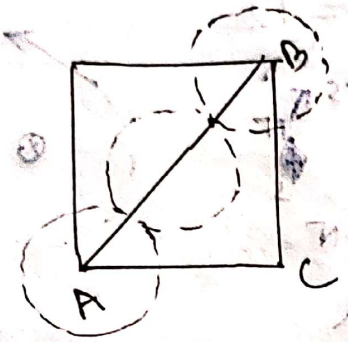
$$r = \frac{\sqrt{3}\,a}{4}$$

$$P = \frac{2 \times \frac{4}{3}\pi r^3}{a^3} = \frac{8/3 \times \pi \times \left(\frac{\sqrt{3}a}{4}\right)^3}{a^3} = \frac{\sqrt{3}\pi}{8}$$

$$= 0.68 = 68\%$$

ফাকা অংশ $= 32\%$

FCC:



$AB = 4r$

$AB^2 = AC^2 + BC^2 = 2a^2$

$(4r)^2 = 2a^2$

$\Rightarrow r = \frac{a}{2\sqrt{2}}$

$$P = \frac{4 \times \frac{4}{3}\pi\left(\frac{a}{2\sqrt{2}}\right)^3}{a^3} = \frac{16}{3} \times \pi \frac{1}{16\sqrt{2}} = \frac{\pi}{3\sqrt{2}}$$

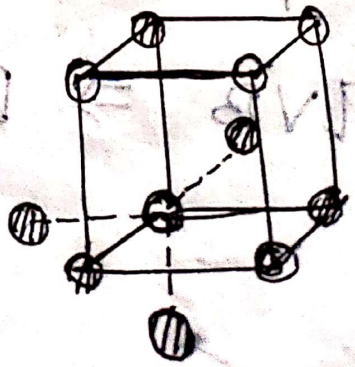
$= 0.74 = 74\%$

ফাঁকা অংশ $= 26\%$

Co-ordination number: No. of nearest neighbours of (any) atom in a structure.

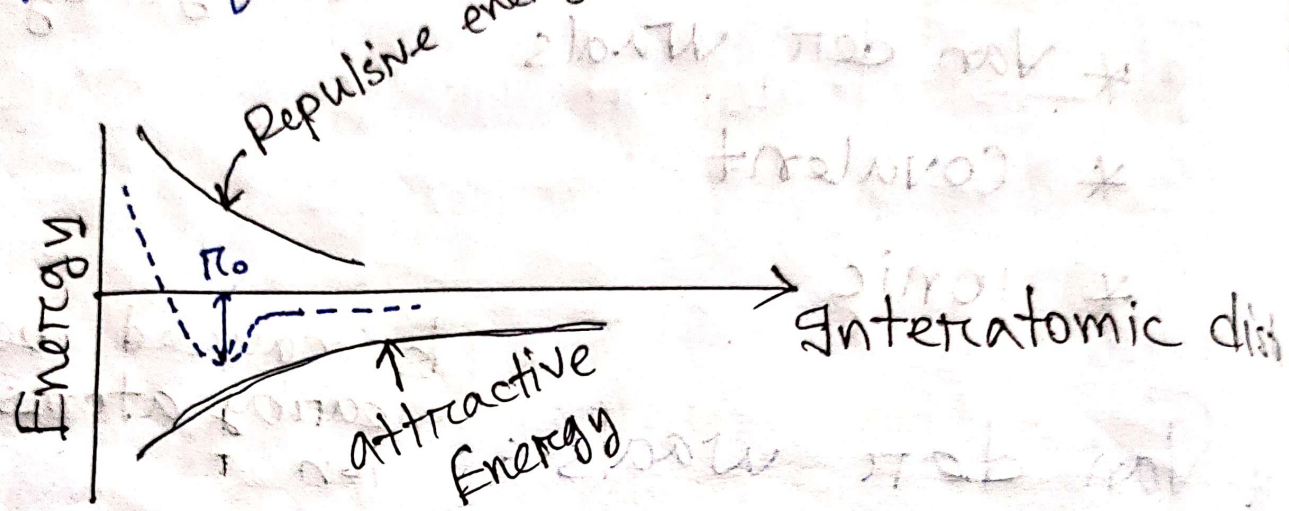
$= \frac{7}{vp}$

For SC, C.N = 6



Packing fraction

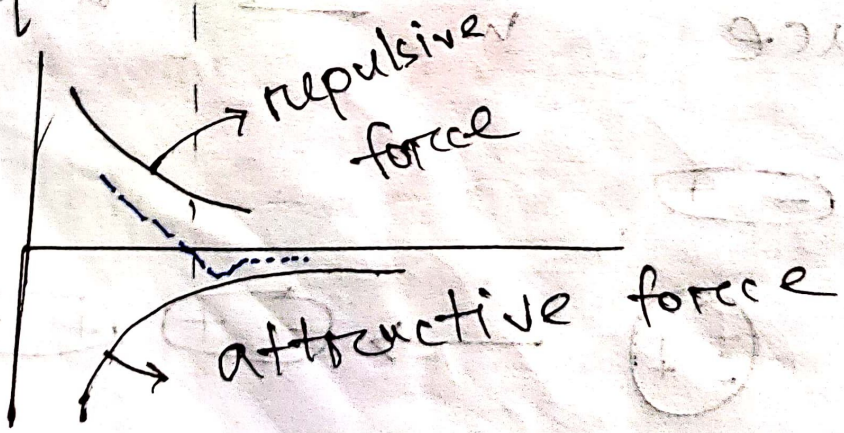
Inter atomic distance and force of equilibrium



at $r = r_0$ → energy is minimum.

↓

Equilibrium distance.



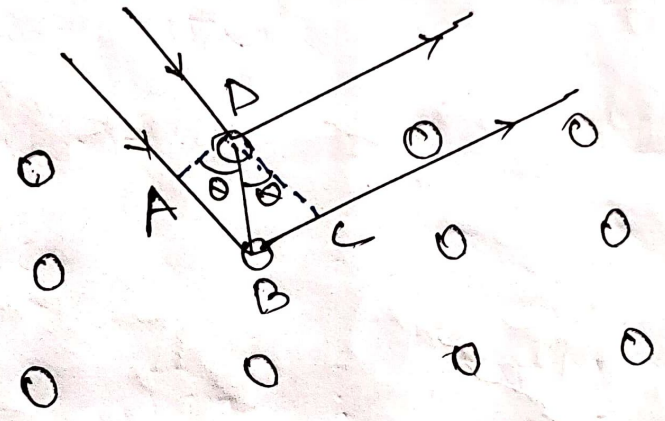
at $r = r_0$, $F = 0$

X-ray diffraction And Bragg's law

$\lambda = 1\text{-}10\,\text{Å}$

40 million রেখা /cm হা, Normal grating a not possible.

but atomic regular structure a X-ray diffraction possible.



$BD = d$

$AB = d \sin\theta$

$BC = d \sin\theta$

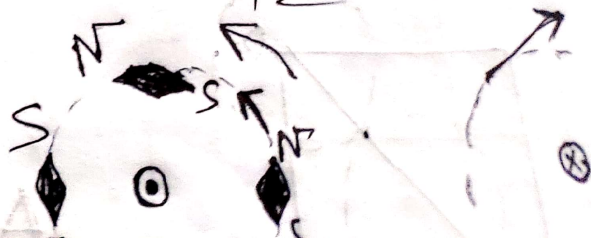
path diff. $= AB + BC = 2d \sin\theta$

For structural interference,

$2d \sin\theta = n\lambda$ (Braggs [a

For bcc, no. of cn = 8

" fcc, " " " = 12



11-2019

Magnetism: