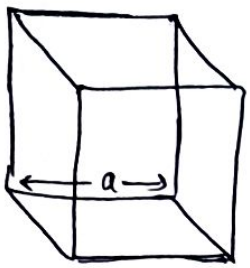

Simple → face → Body

			P.E%	% voids	aN.
①	Simple S.C	$r = \frac{2a}{4} = 0.500a$	52%	100 − 52 = 48%	6
②	fcc or ccp	$r = \frac{\sqrt{2}a}{4} = 0.35a$	74%	100 − 74 = 26%	12
③	Body Bcc	$r = \frac{\sqrt{3}a}{4} = 0.43a$	68%	100 − 68 = 32%	8

$$\rho = \frac{M \times n}{a^3 \times N_A}$$

M → Molar mass g/mol

n → Rank of unit cell (atom)

a → Edge length

N_A → Avogadro No.

$N_A = 6.022 \times 10^{23}$ atom/mol

Note : $1pm = 10^{-12}m$

1 mole ⟶ atoms N_A

• No. of unit cells in Volume 'V' of metal = $\frac{V}{a^3}$

Bravai's lattices are of 14 types

7 Crystal system

C.S				
C	Cubic	0	a = b = c	α = β = γ = 90°
T	Tetragonal	1	a = b ≠ c	α = β = γ = 90°
O	Orthorhombic	2	a ≠ b ≠ c	α = β = γ = 90°
M	Monoclinic	2	a ≠ b ≠ c	α = β = 90°, γ ≠ 90°
T	Triclinic	2	a ≠ b ≠ c	α ≠ β ≠ γ ≠ 90°
R	Rhombohedral	0	a = b = c	α = β = γ ≠ 90°
H	Hexagonal	1	a = b ≠ c	α = β = 90°, γ = 120°

No. of particles in 'x' g of metallic crystals.

M ⟶ N_A particles

x ⟶ $y = \frac{N_A x}{M}$

$\rho = \frac{M \times n}{a^3 N_A}$

$\therefore \rho = \frac{N_A \times n}{M a^3 N_A}$

$M = \frac{xn}{\rho a^3}$

No. of unit cells in 'x' g of metallic crystals.

'n' particles ⟶ 1 unit

$\frac{xn}{\rho a^3}$ ⟶ $y = \frac{x}{\rho a^3}$

If N = n → Rank

Tetrahedral voids = 2N

Octahedral voids = N

① Two nearst tetrahedral voids ka distance = $a/2$

② 2 // octahedral voids ka distance = $\frac{a}{\sqrt{2}}$

③ 2 // tetrahedral & octahedral voids ka distance = $\frac{\sqrt{3}}{4}a$

a → ~~length~~ length / edge

Crystal Defects

- Point defect
  - Stoichiometric defects
    - Interstitial defect
    - Vacancy defect
    - Schottky defect — eg. NaCl, AgI, AgBr, KCl, CsCl
    - Frenkel defects — eg ZnS, AgCl, AgI, AgBr, AgF, CaF_2
  - Impurity defects
    - Substitutional impurity defects — eg. Brass
    - Interstitial imp. Def — eg. stainless steel
- Line defects
  - Non-stoichiometric defects
    - Metal deficiency. D
    - Metal excess. D

1) Each corners → shares → 8 cubes
2) Each face → shares → 2 cubes
3) Each edge → shares → 4 cubes

Ionic solid	Covalent N.	Molecular	Metallic
NaCl, CaF_2	diamond, silica	ice, benzoic acid, WAX	Na, Mg, Cu, Au

Isomorphous: same crystal structure (atomic ratio is same)

Exception: NaCl & KCl is NOT isomorphous

Sulphur → Monoclinic, Rhombic

NaCl → fcc system

No. of Tetrahedral voids = 2 × No. of atoms in unit cell

Polar Molecular solids → are bad conductor of I

Crystalline are → anisotropic
eg. Quartz

Amorphous → Isotropy
eg: Quartz Glass, Glass

The method used to study the structure of crystals is X-rays diffraction

NaF & MgO → 1:1
$NaNO_3$ $CaCO_3$ → 1:1:3

Cristobalite is allotropic form of silica (SiO_2)
- Cristobalite
- α-quartz
- β-quartz

FCC	Aluminum, Copper, Gold, Lead, Nicked, Platinum Silver	# Diamond → C → sp^3 graphite, fullerence → sp^2	Two or more substances having the same crystal structure are isomorphous
BCC	Chromium, Iron, Vanadium, Niobium	Schottky defect	Frenkel Defect
HCP	Cadmium, Cobalt Magnesium, Titanium Zinc, Zirconium	⇒ Density ⇒ ↓ ⇒ Electrical neutrality is preserved	Density = Remains unchanged ⇒ Electrical neutrality is preserved

Hexagonal close packing → ABAB

fcc ≈ ccp → ABCABC

⇒ A single substance that exists in two or more forms or crystalline structure is called polymorphous

Ionic crystals	Covalent crystal	Molecular crystal	Metallic crystal
→ charged ions	→ atoms	→ Molecules	
→ Electrostatic force of attraction	→ covalent bonds	→ Various Inter-molecular forces	→ Metallic Bond
→ Hard & Brittle	→ Very Hard Incompressible	→ soft	→ Malleable, ductile
→ High M.P	→ High M.P & B.P	→ low M.P	
→ Non-conductors of I	→ Poor C. of Heat & I	→ Poor electricCond (good → Insulators)	→ Good Electr. & Thermal C.
eg. NaCl, K_2SO_4, CaF_2, KCl	diamond, quartz-(SiO_2), boron-nitride, carborandum	eg) a) HCl, H_2O, SO_2 b) CH_4, H_2 → c) H_2O (ice), NH_3, HF	eg. Na, k, Ca, Li, Fe, Au, Ag, Co, etc.

The force that holds kernels together in the crystal is called metallic Bond.

= ZnO is white when cold & yellow when heated, it is due to development of metal excess defect.

a) → Weak dipole-dipole
b) London or dispersive
c) Hydrogen Bonding