Density of U.C. :-

$$\text{Density of U.C.} = \frac{\text{mass}}{\text{Volume}}$$

$$d = \frac{\text{mass of all atoms in one U.C.}}{\text{Volume of U.C.}} \quad \ldots (1)$$

$$d = \frac{Z \cdot m\,(\text{amu})}{a^3} \Rightarrow \boxed{d = \frac{Z \cdot M\,(\text{gm})}{a^3 \cdot N_A}}$$

for 1 mol

$n = \frac{w}{m \cdot w}$

$1 = \frac{w}{m \cdot w}$

$w = m \cdot w$

$$d = \frac{Z \cdot M_w}{a^3 \cdot N_A}$$

$d \rightarrow$ density of U.C. in g/cm^3

$Z \rightarrow$ no of atoms/U.C. ; $a \Rightarrow$ edge length in (cm.)

$M_w \Rightarrow$ molar mass ; N_A = Avogadro's no.
$= 6.023 \times 10^{23}$

$1\ nm = 10^{-9}\ m = 10^{-7}\ cm$

$1\ \mathring{A} = 10^{-10}\ m = 10^{-8}\ cm$

$1\ pm = 10^{-12}\ m = 10^{-10}\ cm.$

(8) Ques. Sodium crystalized in B.C.C. unit if distance b/w nearest atom in crystal lattice is $1.73\ \mathring{A}$ then Cal.
(i) edge length of U.C. (ii) density of U.C.

Sol. given :-

(i) distance b/w nearest atom in B.c.c. = $1.73\,\text{Å}$

$$\frac{\sqrt{3}}{2}a = \sqrt{3}\,\text{Å} \Rightarrow a = 2\,\text{Å}$$

$$\boxed{a = 2 \times 10^{-8}\,\text{cm}}$$

(ii) $$d = \frac{Z \cdot M_w}{a^3 \cdot N_A} = \frac{2 \times 23}{(2 \times 10^{-8})^3 \times 6.023 \times 10^{23}}$$

Interstial Voids :-

Gaps formed in blw the touching sphere are kla interstial Voids.

There are two types.

(i) planner Voids

(ii) Non planner Voids.

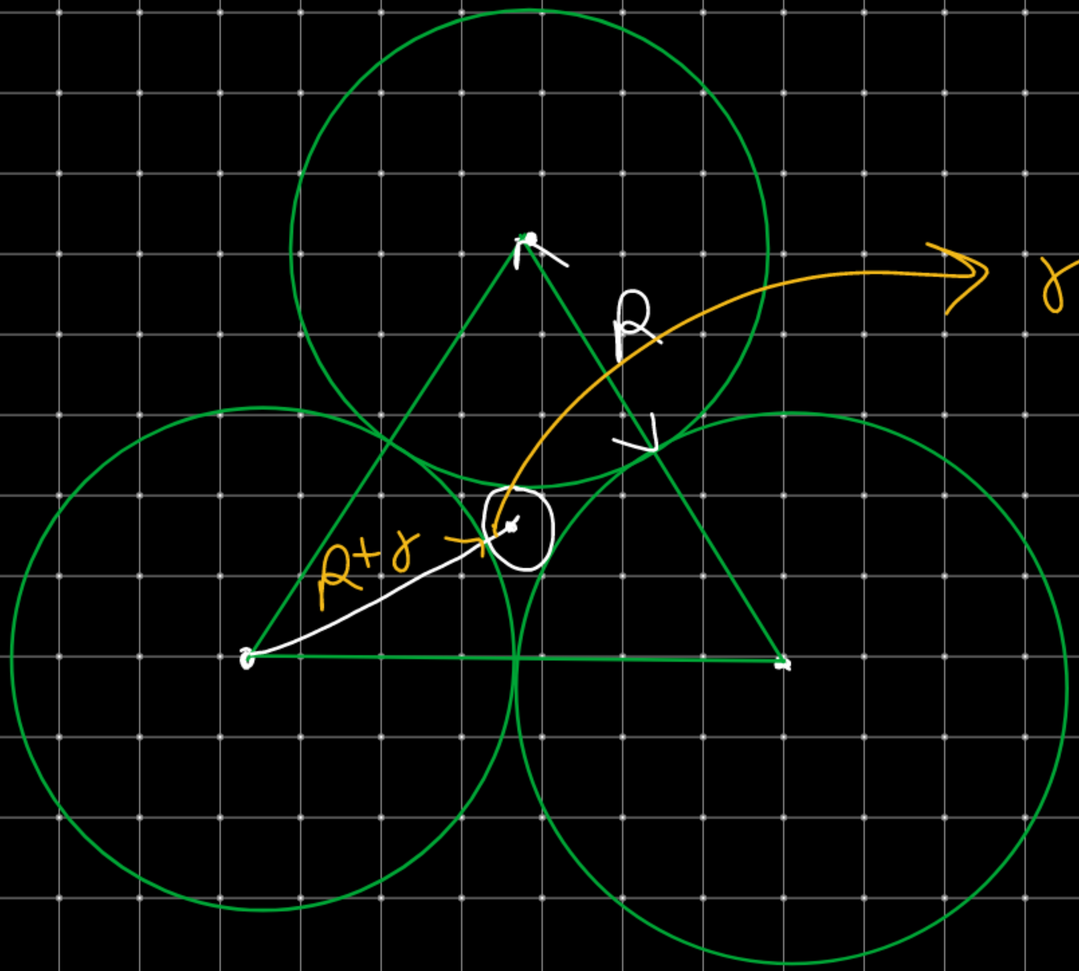
(1) Planner Void :-

Void in which Centre of Sphere and Centre of Void in Same plane.

(i) Triangular Void (ii) Square Void.

(i) Triangular Void :-

Void by touching 3-Sphere in Same plane.



$r \quad \frac{r}{R} = 0.155$

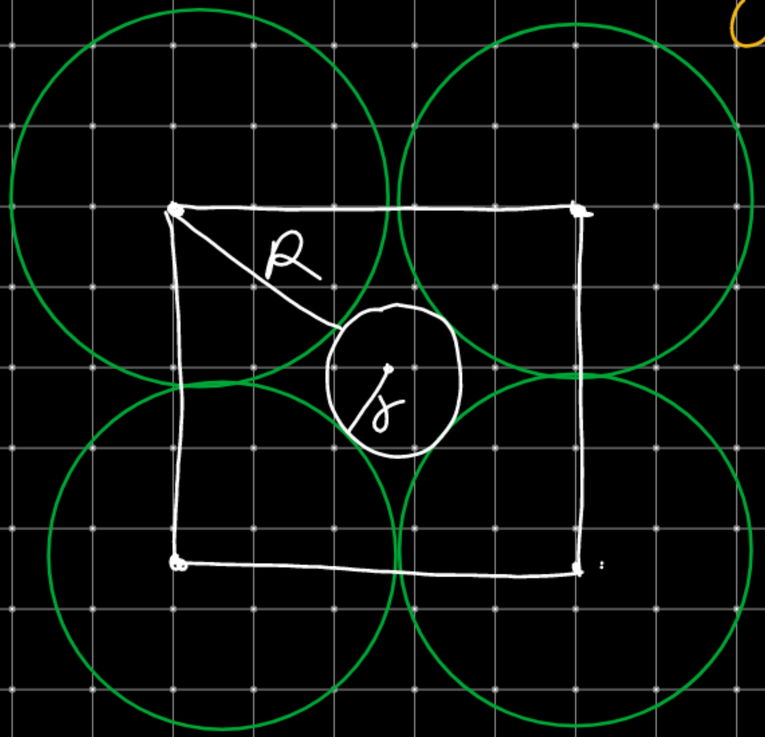
$r \rightarrow$ Void radius

$$\frac{r_+}{r_-} = 0.155$$

r_- → radius of sphere

(2) Square Void :-

Void form by touching 4-Sphere



$$\frac{r}{R} = 0.414 = \frac{r^+}{r^-}$$

(2) Non-planner Void :-

Void in which Centre of Sphere and Centre of Void are not in same plane.

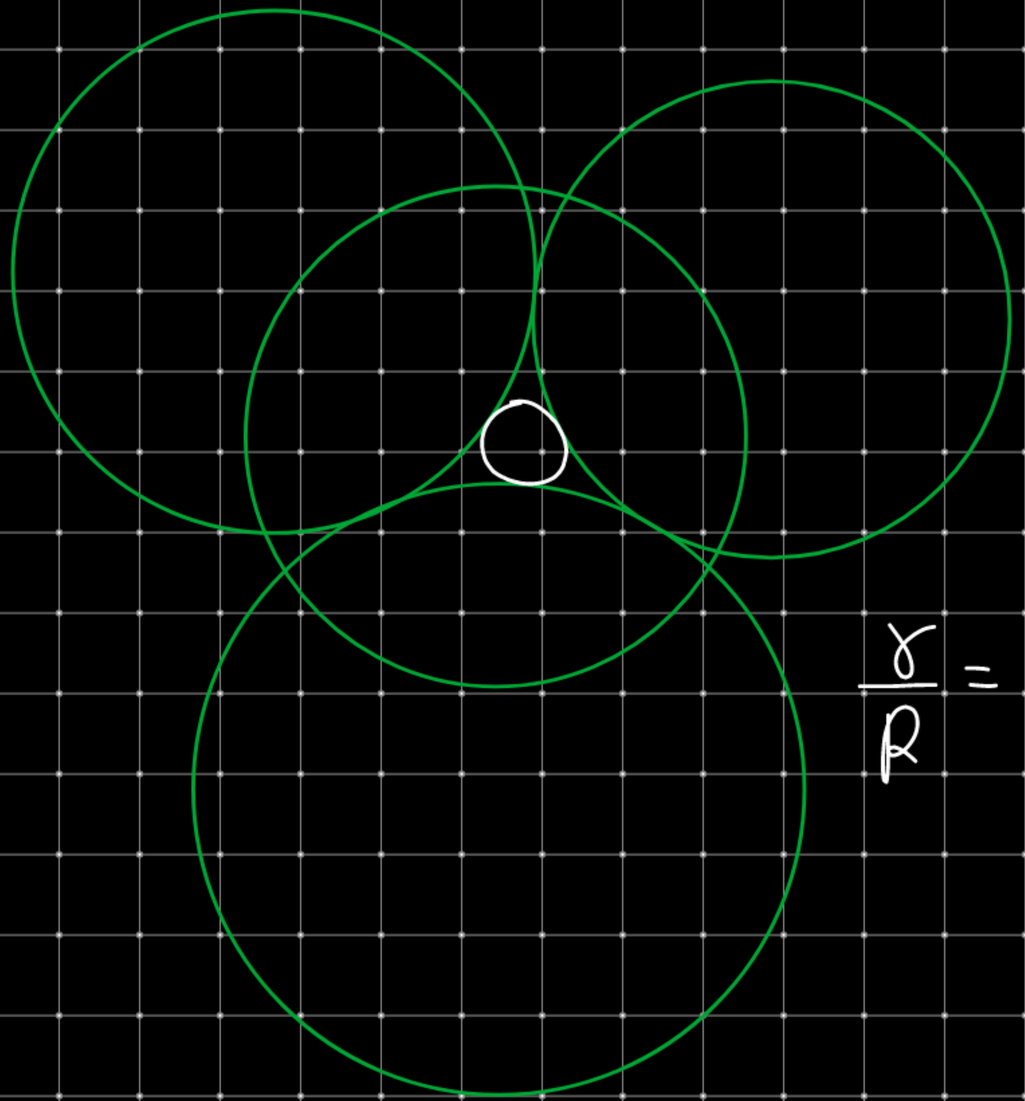
(i) Tetrahedral

(ii) octahedral

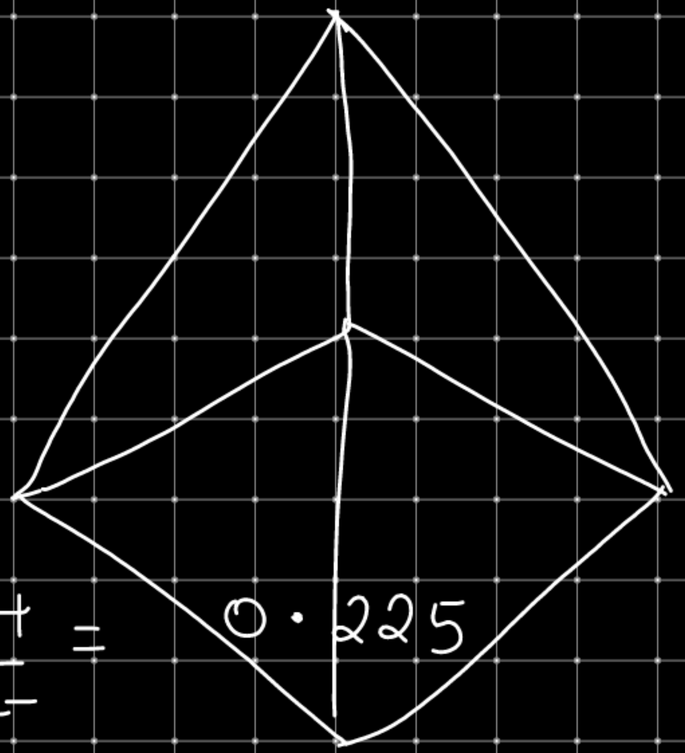
(iii) Cubical.

(i) Tetrahedral void :-

Voids form by touching 4-Sphere, 3-Sphere in same plane and 1-Sphere upper or bottom plane is k/a tetrahedral void.



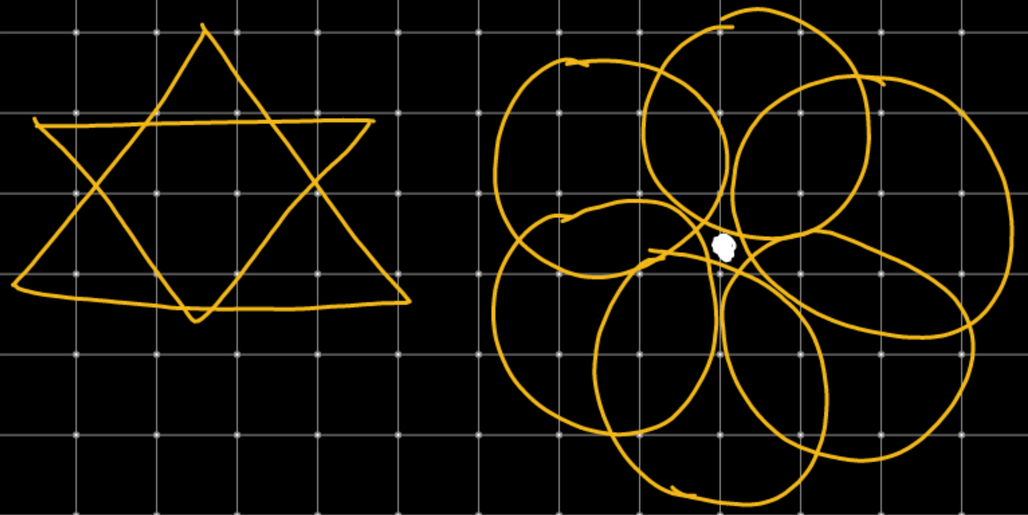
$$\frac{r}{R} = \frac{r+}{1-} =$$



(ii) Octahedral Void :-

Touching by 6-Sphere

3-Same Plane + 3 (upper or bottom plane)

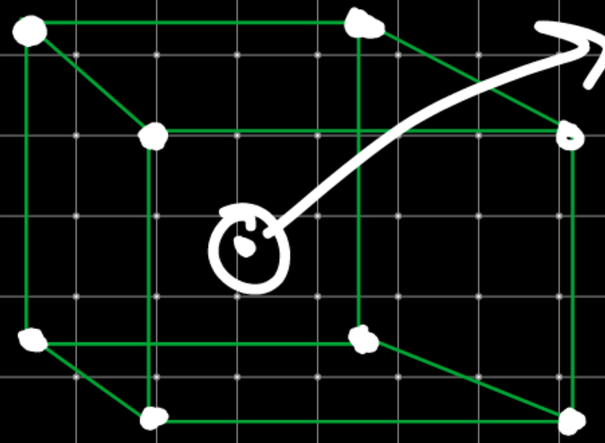


$$\frac{r}{R} = \frac{\sqrt{2}}{1} = 0.414$$

(iii) Cubical Void :

8 - Sphere are touching

4 Same plane + 4 (upper or bottom) plane



Void. $\frac{\gamma}{R} = 1 = \frac{\gamma^+}{\gamma^-}$

Close Packing in Crystal :-

$$d = \frac{2 \times 23}{8 \times 10^{-24} \times 6.023 \times 10^{23}}$$

$$d = \frac{230}{24}$$

$$\boxed{d = 9.58 \text{ g/cm}^3}$$