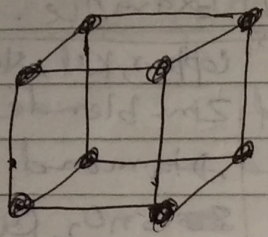
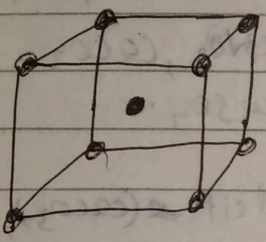
Number of atoms in unit cell :—

(i) No. of atoms in S.C.C = Corners × $\frac{\text{atom}}{\text{Corners}}$



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

(ii) No. of atoms in b.c.c = Corners × $\frac{\text{atom}}{\text{Corners}}$ + Centre × $\frac{\text{atom}}{\text{Centre}}$



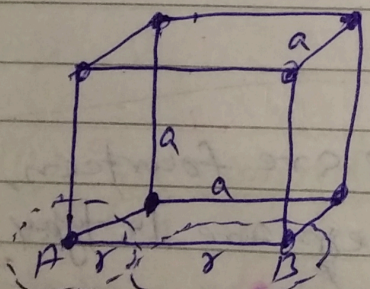
$= 8 \times \frac{1}{8} + 1 \times \frac{1}{1} = 1+1 = 2$ atoms

(iii) No. of atoms in F.C.C = Corners × $\frac{\text{atom}}{\text{Corners}}$ + Faces × $\frac{\text{atom}}{\text{face}}$

$= 8 \times \frac{1}{8} + 6 \times \frac{1}{2} = 1+3 = 4$ atoms

Atomic radius in unit cell

(i) In primitive or Simple cubic cell (S.C.C) —



Since, Atoms in solid are very closed to each other.

Hence Neighbouring particle distance, $d = AB = 2r = a$

or, $a = 2r = d$

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

& $\boxed{r = \frac{d}{2}}$

or $\boxed{d = 2r}$

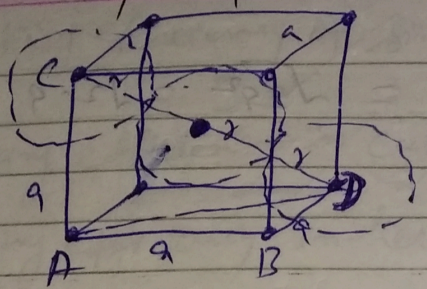
where —

d = Neighbouring particle distance

a = edge

r = Atomic radius

(ii) In body centred cell (b.c.c) —



Here, Neighbouring particle distance, $d = \frac{1}{2} CD$

From ΔABD —

$$AD = \sqrt{AB^2 + BD^2} = \sqrt{a^2 + a^2} = \sqrt{2a^2}$$

Now, from ΔACD —

$$CD = \sqrt{AC^2 + AD^2} = \sqrt{a^2 + 2a^2} = \sqrt{3a^2} = \sqrt{3} \cdot a$$

$\therefore d = \frac{1}{2} CD = \frac{1}{2} \times \sqrt{3} \cdot a$

or, $\boxed{d = \frac{\sqrt{3}}{2} \cdot a}$

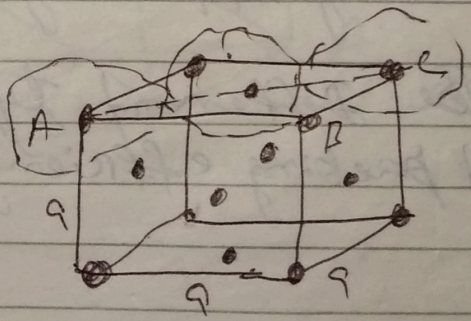
$\because d = 2r$

$\therefore r = \frac{d}{2} = \frac{1}{2} \times \frac{\sqrt{3}}{2} \cdot a$

$\therefore \boxed{r = \frac{\sqrt{3}}{4} a}$

$\therefore \boxed{a = \frac{4r}{\sqrt{3}}}$

(iii) In face centred cell —



Neighbouring particle distance, $d = \frac{1}{2} AC$

from $\triangle ABC$ —

$$AC = \sqrt{AB^2 + BC^2} = \sqrt{a^2 + a^2} = \sqrt{2a^2} = \sqrt{2} \cdot a$$

$$\therefore d = \frac{1}{2} = \frac{\sqrt{2}}{2\sqrt{2}} \cdot a = \frac{a}{\sqrt{2}}$$

$$\therefore d = 2r$$

$$\therefore r = \frac{d}{2} = \frac{a}{2\sqrt{2}}$$

$$\therefore \boxed{r = \frac{a}{2\sqrt{2}}}$$

& $\boxed{a = 2\sqrt{2}\, r}$

S.c.c →	$r = \frac{a}{2}$	$a = 2r$	$d = 2r = a$
b.c.c →	$r = \frac{\sqrt{3}}{4} a$	$a = \frac{4r}{\sqrt{3}}$	$d = \frac{\sqrt{3}}{2} \cdot a$
f.c.c →	$r = \frac{a}{2\sqrt{2}}$	$a = 2\sqrt{2}\, r$	$d = \frac{a}{\sqrt{2}}$