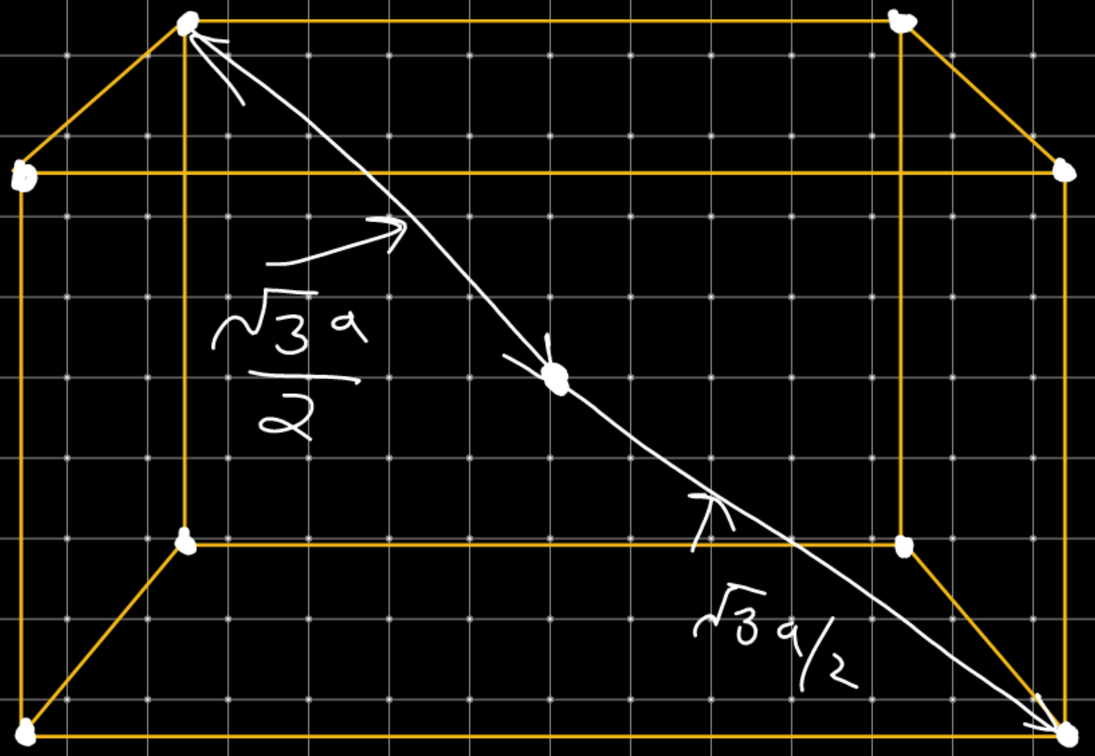
# Body Centre Cubic U.C. :-

Atoms are present at Corner as well as body Centre.

(1) No of atoms/ U.C. (Z)

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

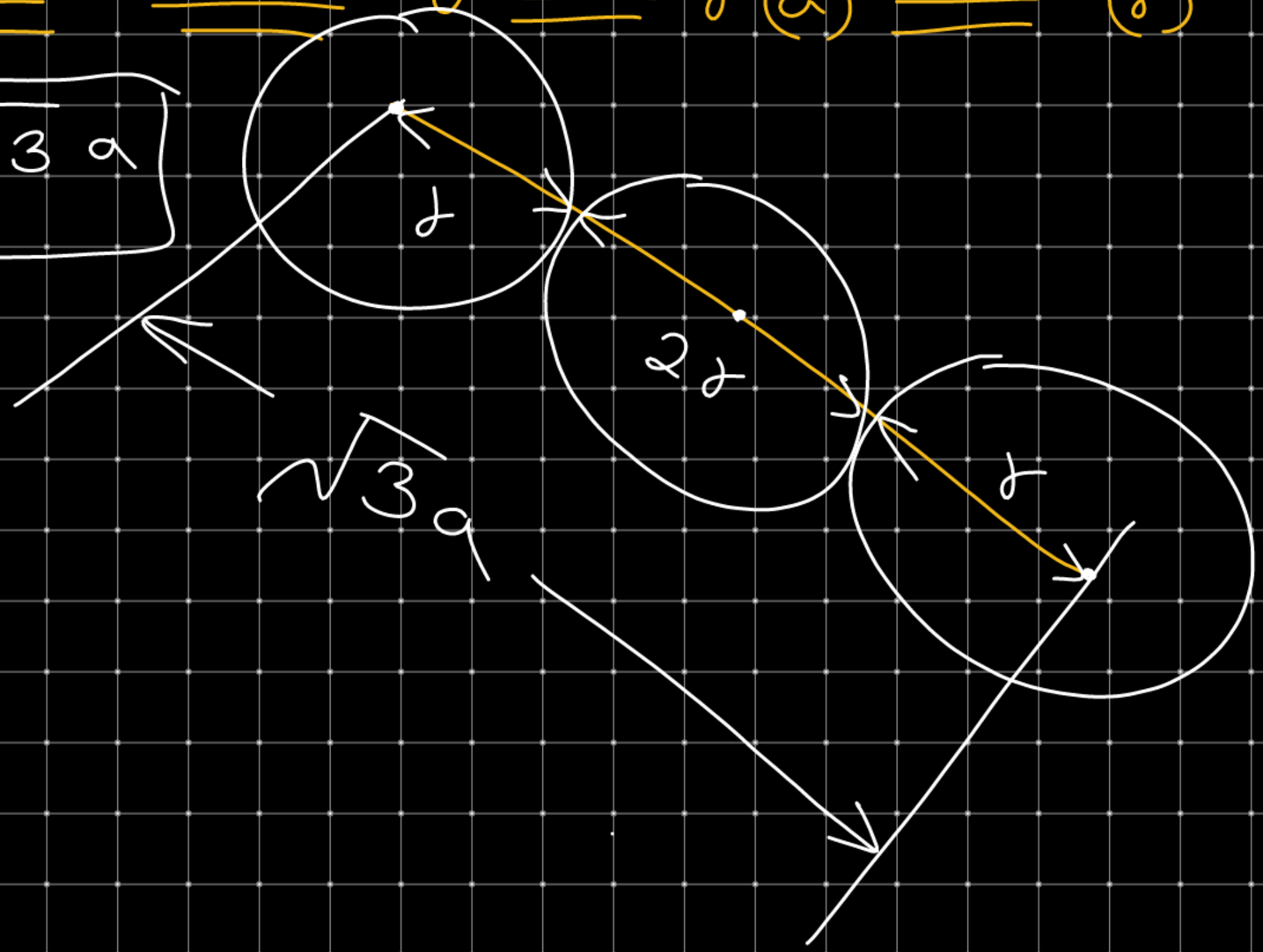
$$Z = 2 \text{ atoms/ U.C.}$$



(2) Relation b/w edge length (a) and radius (r) of

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

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



(3) Co-ordination Number (C.N.)

C.No. = 8

Nearest distance b/w two atoms in B.c.c. = $\frac{\sqrt{3}\,a}{2}$

(4) Packing efficiency (P.E./P.F.) :-

$$P.F = \frac{Z \times 4/3\ \pi r^3}{a^3}$$

$$P.F. = \frac{2 \times \frac{4}{3}\pi r^3}{a^3}$$

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

$$P.F. = \frac{\cancel{2} \times \frac{4}{\cancel{3}}\pi \times \frac{\sqrt{3}\,a}{4} \times \frac{\sqrt{3}\,a}{\cancel{4}_2} \times \frac{\sqrt{3}\,a}{4}}{\cancel{a^3}}$$

$$P.F. = \frac{\sqrt{3}\,\pi}{8}$$

$$P.E. = \frac{\sqrt{3} \times 3.14}{8} \times 100 = 68\%$$

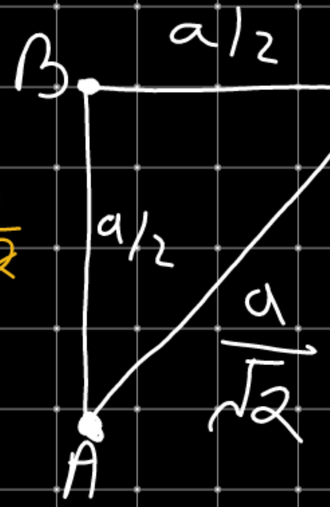
# Face Centre Cubic U. C. (F. C. C.)

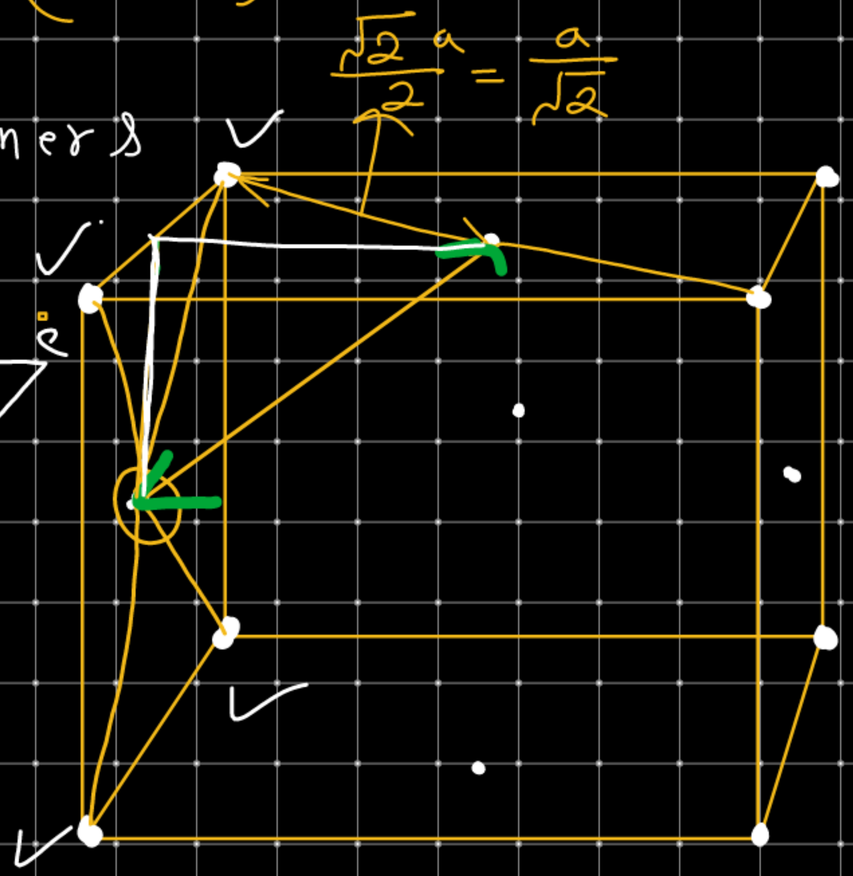
Atoms are present at corners as well as face centre.

(1) $Z = ?$

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

$$Z = 4 \text{ atoms/U.C.}$$

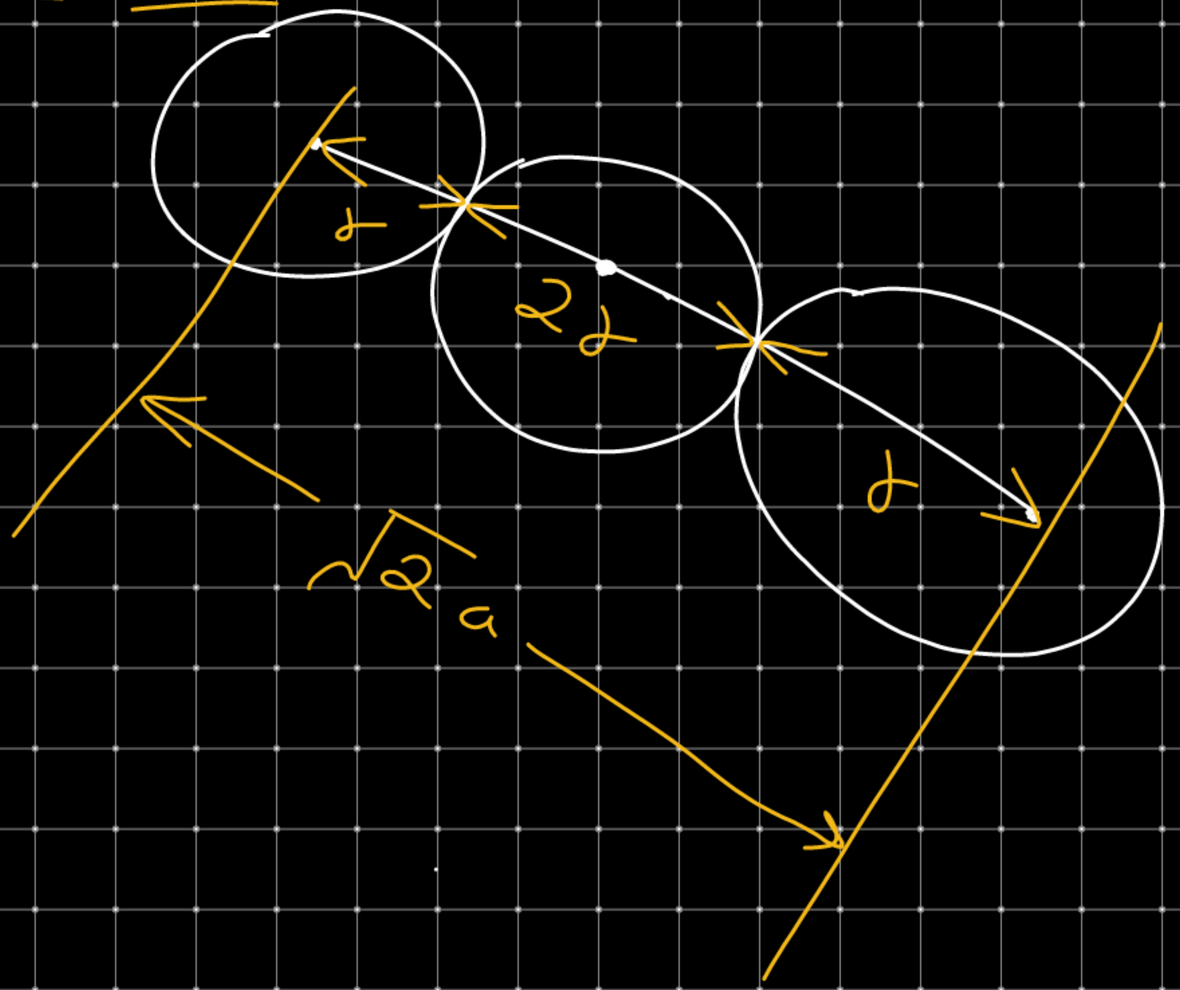


(2) Relation b/w a and $\gamma$ :-

$$4\gamma = \sqrt{2}\,a$$

$$\boxed{\gamma = \frac{\sqrt{2}\,a}{4}}$$



(3) Co-ordination number :-

Nearest distance b/w two atoms in F.C.C. $= \frac{a}{\sqrt{2}}$

C.No. = 4(corner) + 4(Face centre in Front U.C.) + 4 (Face centre Back U.C.)

**C.No. = 12**

(4) Packing fraction / Packing efficiency :-

$$P.F. = \frac{Z \times \frac{4}{3}\pi r^3}{a^3}$$

$$r = \frac{\sqrt{2}a}{4}$$

$$P.F. = \frac{4 \times \frac{4}{3}\pi r^3}{a^3} = \frac{4 \times \frac{4}{3}\pi \times \frac{\sqrt{2}}{4}a \times \frac{\sqrt{2}}{4}a \times \frac{\sqrt{2}}{4}a}{a^3}$$

$$P.F. = \frac{2\sqrt{2}\pi}{12} = P.F. = \frac{\sqrt{2}\pi}{6}$$

$$P.E. = \frac{\sqrt{2}}{6} \times 3.14 \times 100$$

$$\boxed{P.E. = 74\%}$$

**Ques.** A element is crystallise in B.C.C. manner and the edge length is 4 Å

Cal:

(i) $\gamma_{atom}$ (ii) distance b/w two nearest atom.

(iii) $V_{atom}$.

**Sol.** given :- B.C.C.

$$a = 4\text{ Å}$$

(i) $4\gamma = \sqrt{3}\,a$

$$\gamma = \frac{\sqrt{3}}{4} \times 4$$

$$\boxed{\gamma = \sqrt{3}\ \text{Å}}$$

(ii) distance b/w two atoms in B.C.C. $= \frac{\sqrt{3}\,a}{2}$

$$= \frac{\sqrt{3}}{2} \times 4a = 2\sqrt{3}\ \text{Å}$$

(ii) $$V_{atom} = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi \sqrt{3} \times \sqrt{3} \times \sqrt{3}$$

$$\boxed{V_{atom} = 4\sqrt{3}\,\pi}$$

(8).2. Volume of a F.C.C. U.C. is $8 \times 10^{-24}\ cm^3$

then Cal. (i) edge length (ii) $\gamma_{atom}$

(iii) diameter.

Sol. given :-

(i) Volume of U.C. $= 8 \times 10^{-24}\ cm^3$

$a^3 = 8 \times 10^{-24}$

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

(ii) $4\gamma = \sqrt{2}\, a$

$\gamma = \frac{\sqrt{2}}{4} \times 2 \times 10^{-8}$

$\gamma = \frac{1}{\sqrt{2}} \times 10^{-8}$

(iii) $d = 2\gamma$

Q.3. K metal arranged in BCC manner.

Find no. of Unit cell in 3.9 gm of K {At wt. of K = 39}

Sol. We know in BCC. Z = 2 atoms/U.C.

2 atom ⟶ 1 U.C.

1 atom ⟶ $\frac{1}{2}$ U.C.

$6.02\times10^{22}$ atoms ⟶ $\frac{1}{2}\times6.02\times10^{22}$

$= 3.01\times10^{22}$ U.C.

atoms = n · $N_A$

$= \frac{3.9}{39}\times6.023\times10^{23}$

$= 6.023\times10^{22}$ atoms.