Brainbox learn easy

Unit 1

The Solid State

BCC (Body Centered Cubic):

In BCC particles meet along body diagonal.

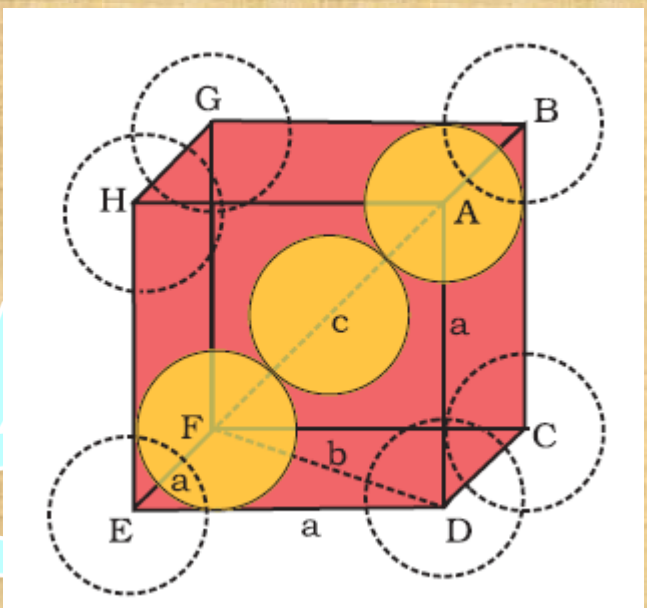

Fig. Body-centred cubic unit cell (sphere along the body diagonal are shown with solid boundaries)

Let ‘a’ is the edge length, ‘b’ is face diagonal and ‘c’ is body diagonal in the unit cell.

In ΔEFD, $b^2 = a^2 + a^2 \Rightarrow b^2 = 2a^2 \Rightarrow b = \sqrt{2}a$

In ΔAFD, $c^2 = a^2 + b^2 = a^2 + 2a^2 = 3a^2 \Rightarrow c = \sqrt{3}a$

If ‘r’ is radius of sphere, $C = 4r = \sqrt{3}a \Rightarrow \boxed{a = \frac{4r}{\sqrt{3}}}$

No of particles = $8 \times \frac{1}{8} + 1 \times 1 = 1 \times 1 = 2$

Packing efficiency = $\frac{\text{No.of particles} \times \text{volume of sphere}}{\text{Total volume of unit cell}} \times 100$

$$= \left(\frac{2 \times \frac{4}{3} \pi r^3}{\left(4r / \sqrt{3}\right)^3} \right) \times 100$$

= 68 %

Void space = 100 – 68 = 32%