AHSEC

Q & A discussion **Solid State**

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(1) Which of the following lattices has the highest packing efficiency?

(a) Simple cubic closed packed (ccp) lattice

(b) body-Centred cubic (bcc) lattice

(c) hexagonal closed packed (hcp) lattice

Soln → (c) hcp lattice

Q → A compound forms hexagonal close packed (hcp) structure. What is the Total number of voids in 0.5 mol of it? How many of these are Tetrahedral voids?

Soln → 1 mole has ⇒ 6.02×10^{23} particles

⇒ So, 0.5 mole has ⇒ $0.5 \times 6.02 \times 10^{23}$

$= 3.011 \times 10^{23}$ particles.

∴ No. of octahedral voids = no. of particles/atoms in the close packing

$= 3.011 \times 10^{23}$

∴ No. of Tetrahedral voids = 2 × no. of particles/atoms in packing

$= 2 \times 3.011 \times 10^{23} = 6.02 \times 10^{23}$

∴ Total no. of voids = Octahedral voids + Tetrahedral voids

$= 6.022 \times 10^{23} + 3.011 \times 10^{23}$

$= 9.03 \times 10^{23}$

Q → What is the formula of a compound in which the element Y forms cubic closed packed (CCP) lattice and atoms of X occupy $1/3^{rd}$ of Tetrahedral voids? (1)

Soln → No. of Tetrahedral voids formed = 2 × no. of element 'Y'

∴ Total no. of atoms of 'Y' element in CCP structure like FCC ⇒ '4'

So, no. of Tetrahedral voids = 2 × 4 = 8

no. of Tetrahedral voids occupied by 'X' atoms

$= \frac{1}{3} \times 8$

So, the ratio of X and Y

$\Rightarrow X : Y = 8/3 : 4 = 2 : 3$

So, the formula ⇒ X_2Y_3

Q → Calculate the packing efficiency of a simple cubic lattice. (3)

Soln → already discussed in the class.
