

Question:- Find the Miller indices of the planes that makes intercepts on a, b and c axes, $3A^\circ$, $4A^\circ$ and $3A^\circ$ in a tetragonal axes with $\frac{c}{a} = 1.5$.

Solution \Rightarrow $OA = 3A^\circ, OB = 4A^\circ, OC = 3A^\circ$

$$(hkl) = \frac{a}{OA} : \frac{b}{OB} : \frac{c}{OC}$$

$$= \frac{a}{3A^\circ} : \frac{a}{4A^\circ} : \frac{1.5a}{3A^\circ}$$

$$(hkl) = \frac{1}{3} : \frac{1}{4} : \frac{1}{2}$$

\therefore For tetragonal $a = b$.

$$\boxed{(hkl) = (436)}$$

Question - Determine the Miller indices of a plane that makes intercepts $2A^\circ, 3A^\circ, 4A^\circ$ on a co-ordinate axes of orthorhombic crystal with $a:b:c = 4:3:2$.

Solution:-

$$h:k:l = \frac{a}{OA} : \frac{b}{OB} : \frac{c}{OC}$$

$$= \frac{4}{2} : \frac{3}{3} : \frac{2}{4} = \frac{4}{2} : \frac{3}{3} : \frac{2}{4}$$

$$(hkl) = \left(2 \ 1 \ \frac{1}{2}\right) = (421)$$

Question A plane makes intercepts of $1a$, $2a$ & parallel to, a , b and c axes respectively. Find the Miller indices if $a:b:c = 3:2:1$.

$$(h:k:l) = \frac{a}{OA} : \frac{b}{OB} : \frac{c}{OC} = \frac{3}{1} : \frac{2}{2} : \frac{1}{\infty}$$

$$(hkl) = (3 \ 1 \ 0)$$

Qmp.
* Relation b/w mass density (ρ_m) and no. density (ρ)

$$\text{No. of atom/unit volume} = \frac{NA \rho_m}{MA} \text{ unit/cm}^3 \text{ or /m}^3$$

Average no.

Since ρ is Avogadro's no. $NA = 6.02 \times 10^{23}$

$NA = 6.02 \times 10^{26}$ if $\rho_m \rightarrow \text{gm/cm}^3$ or $\frac{\text{gm}}{\text{cm}^3}$

if $\rho_m \rightarrow \text{kg/cm}^3$ or $\frac{\text{kg}}{\text{m}^3}$

$$MA = a \cdot m \cdot u$$

For a cubic crystal,

$$\text{volume} = a^3$$

if unit cell contains n atom then no. density.

$$= \frac{n}{a^3} = \frac{NA \rho_m}{MA}$$

$$\Rightarrow a = \left(\frac{n MA}{NA \rho_m} \right)^{1/3}$$

cm or m.

$n \Rightarrow$ no. of atom per unit cell.