



# **SNS COLLEGE OF ENGINEERING**

**Coimbatore-641 107**

**( An Autonomous Institution )**

Accredited by NBA & NAAC with 'A' Grade

Approved by AICTE, New Delhi & Recognized by UGC

Affiliated to Anna University, Chennai

## **DEPARTMENT OF PHYSICS**

**COURSE NAME :19PY101-ENGINEERING PHYSICS**

**I YEAR / I SEMESTER**

**UNIT 4 – CRYSTAL PHYSICS**

**TOPIC 3 – MILLER INDICES – INTER-PLANAR DISTANCES**





1. How do you find the Miller indices of a plane?
2. Why do we use Miller indices?
3. How do you calculate lattice spacing?



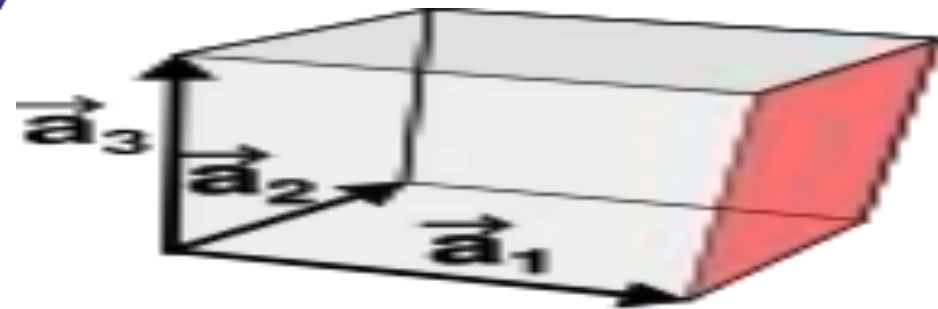


- **Miller indices** form a notation system in crystallography for planes in crystal lattices.

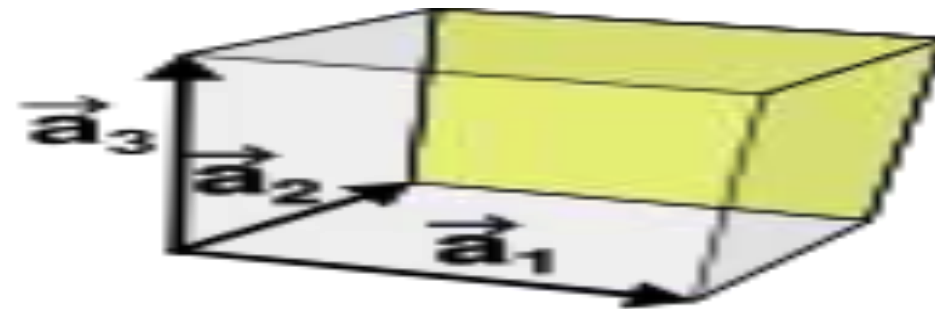
A family of lattice plane is determined by three integers  $h$ ,  $k$ , and  $l$ , the *Miller indices*.

- Cubic crystals with lattice constant  $a$ , the spacing  $d$  between adjacent  $(hkl)$  lattice planes is

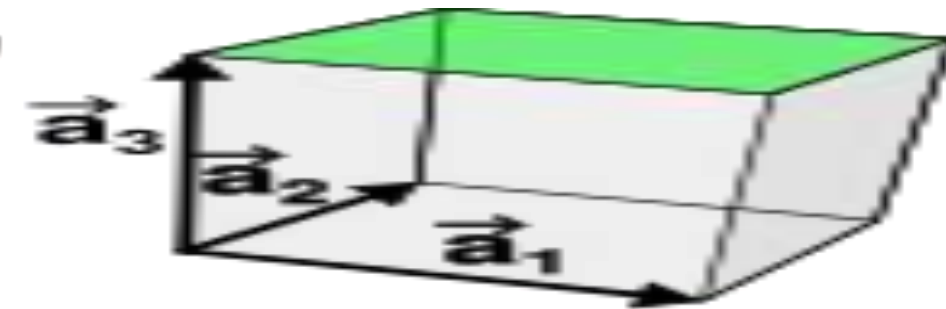
- $D_{hkl} = a/$



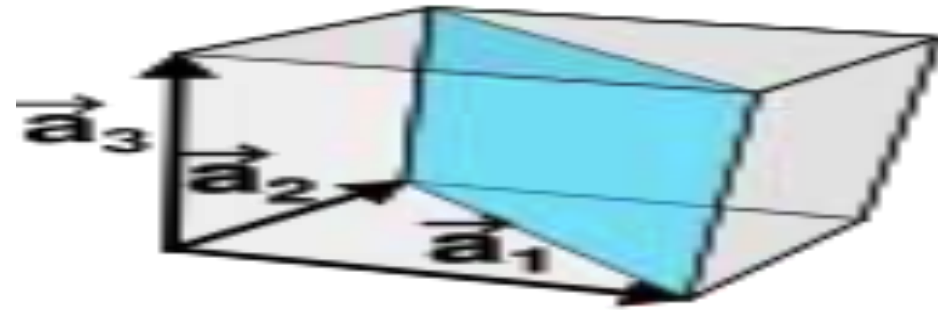
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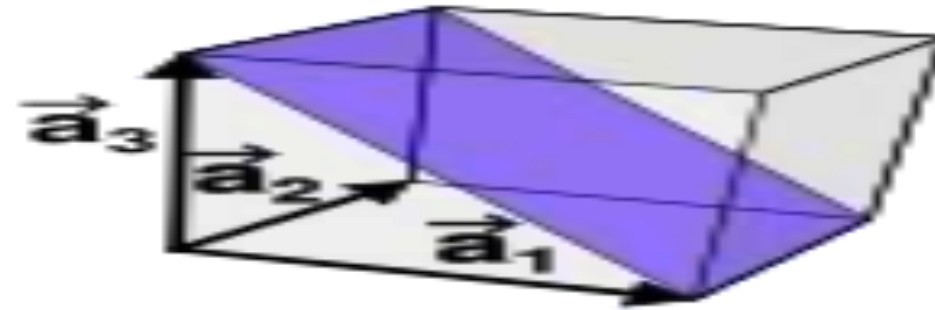
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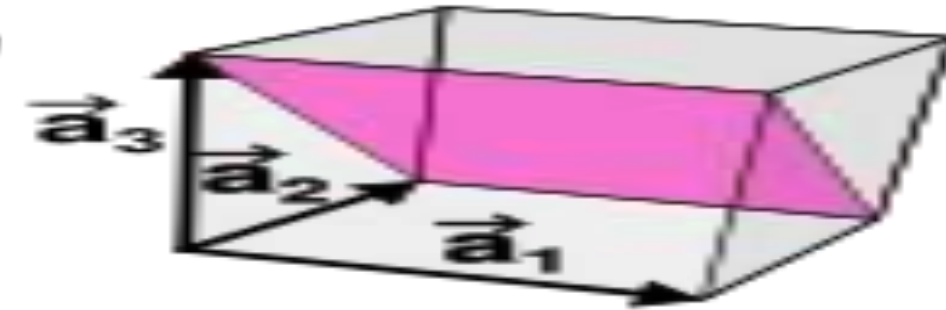
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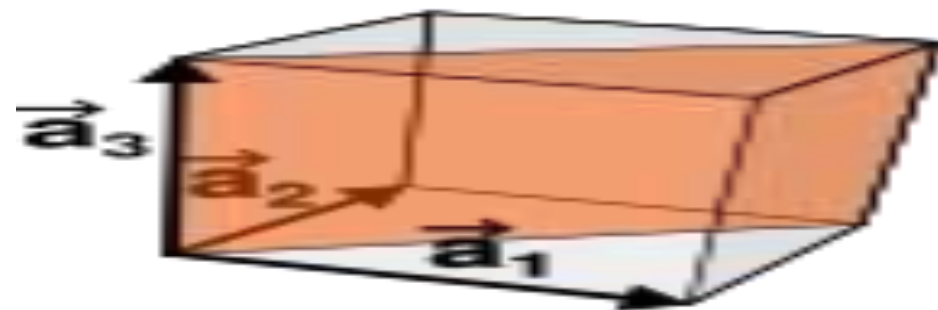
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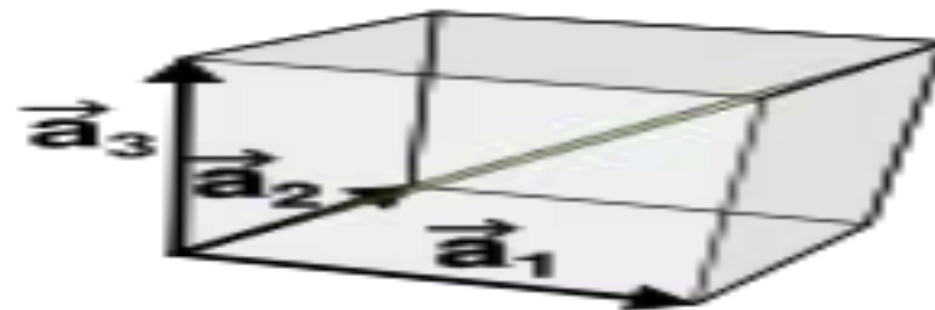
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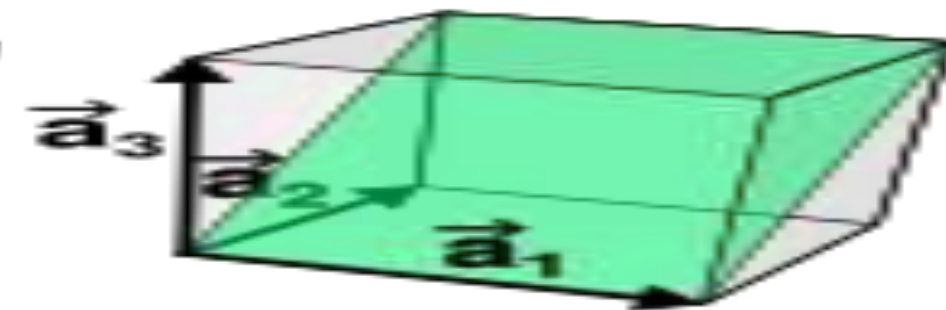
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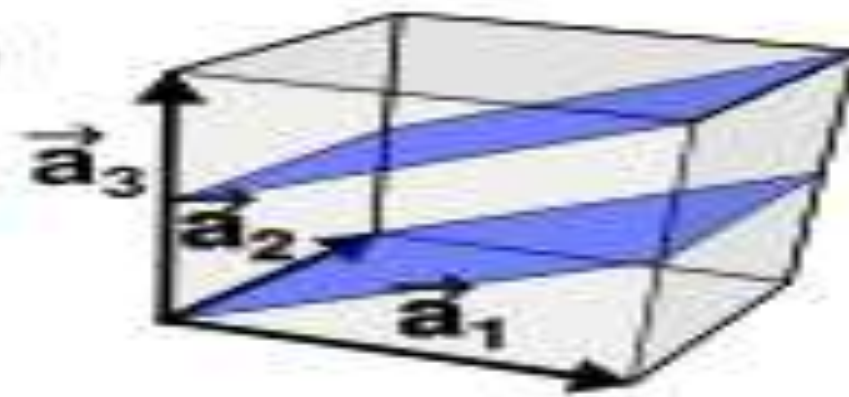
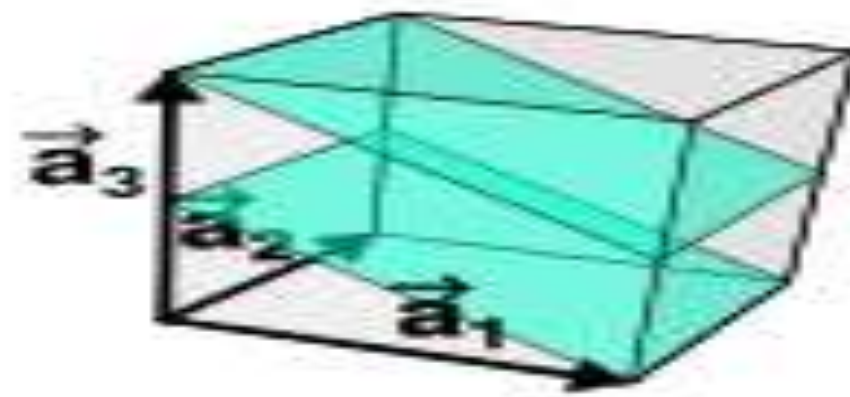
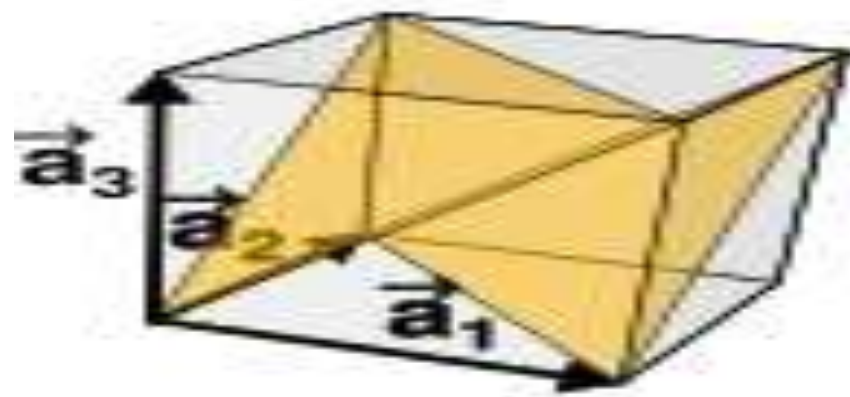
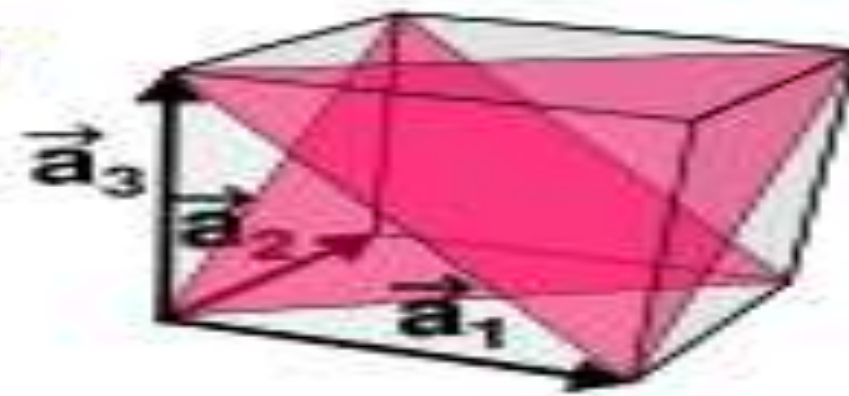
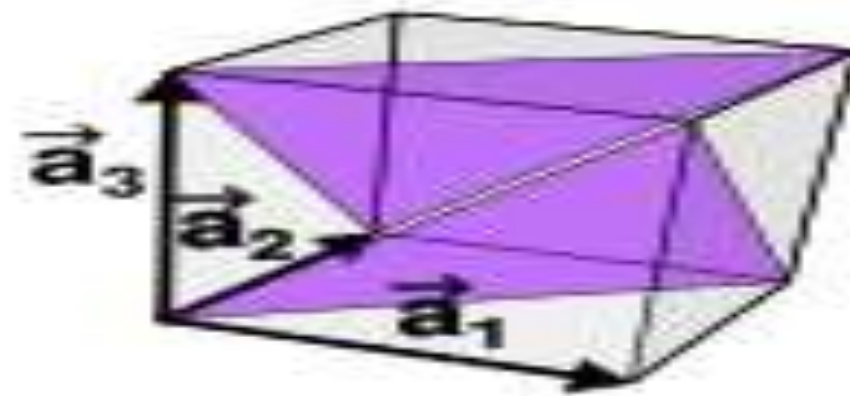
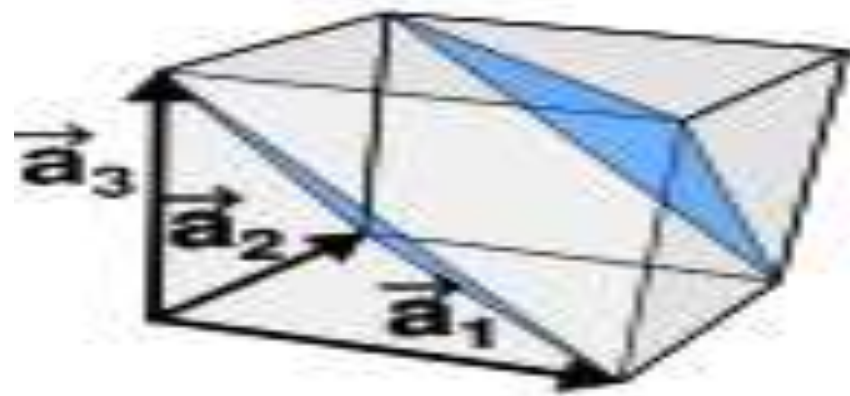
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# ASSESSMENT - 1

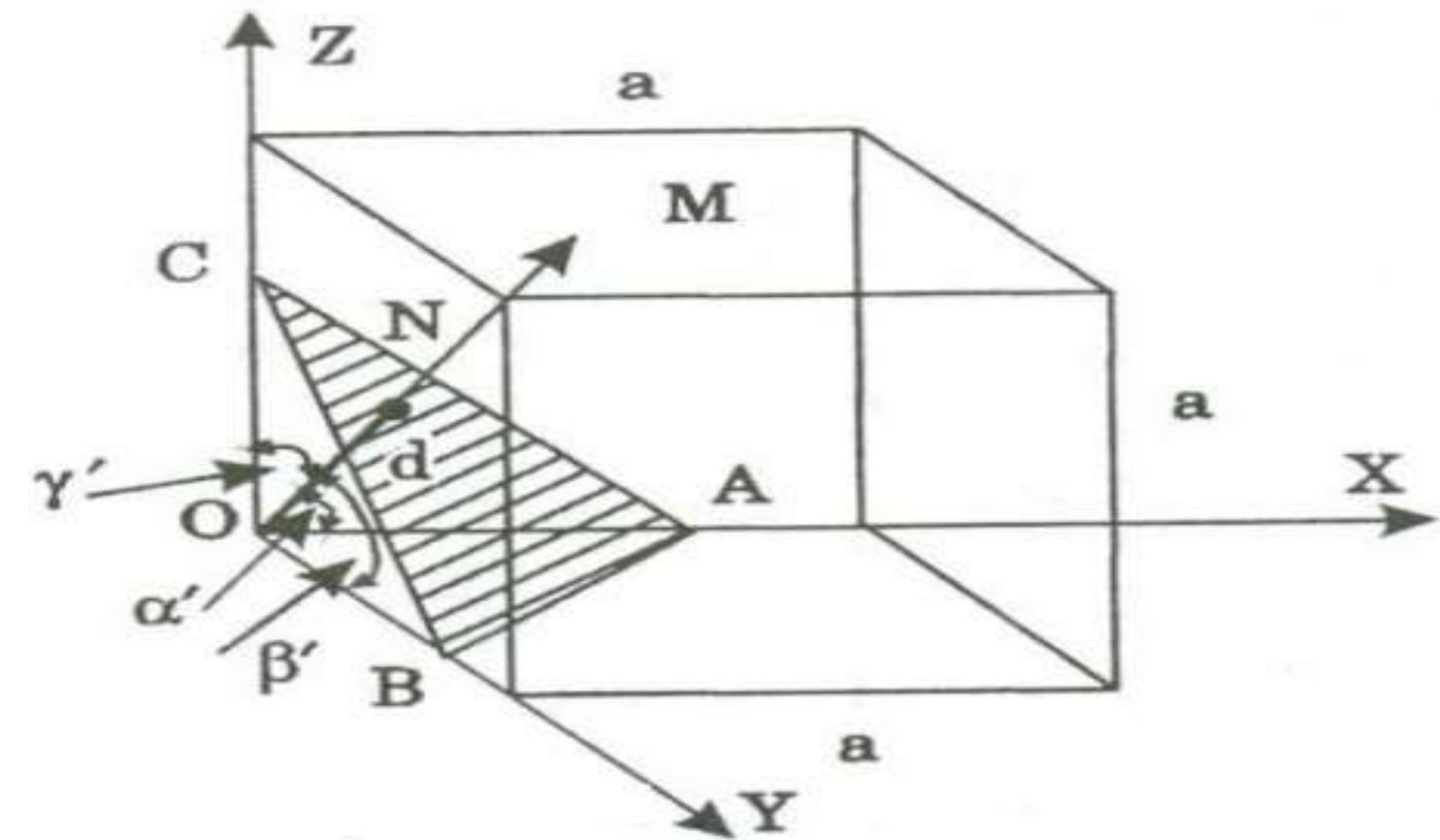
Find the miller indices for following figures



# INTER PLANER DISTANCE

Inter planar spacing, which is the separation between sets of parallel planes formed by the individual cells in a lattice structure, depends on the radii of the atoms forming the structure as well as on the shape of the structure.

$$d_{hkl} = \frac{a}{\sqrt{h^2 + k^2 + l^2}}$$





$$\cos \alpha' = \frac{OM}{OA'} = \frac{d_2}{2a/h} = \frac{d_2 h}{2a}$$

$$\cos \beta' = \frac{OM}{OB} = \frac{d_2}{2a/k} = \frac{d_2 k}{2a}$$

$$\cos \gamma' = \frac{OM}{OC} = \frac{d_2}{2a/l} = \frac{d_2 l}{2a}$$

$$\therefore \cos \alpha' : \cos \beta' : \cos \gamma' = \frac{d_2 h}{2a} : \frac{d_2 k}{2a} : \frac{d_2 l}{2a}$$

$$\therefore \left( \frac{d_2 h}{2a} \right)^2 + \left( \frac{d_2 k}{2a} \right)^2 + \left( \frac{d_2 l}{2a} \right)^2 = 1$$

$$\frac{d_2^2 h^2}{4a^2} + \frac{d_2^2 k^2}{4a^2} + \frac{d_2^2 l^2}{4a^2} = 1$$

$$\frac{d_2^2}{4a^2} (h^2 + k^2 + l^2) = 1$$

$$d_2^2 = \frac{4a^2}{h^2 + k^2 + l^2}$$

$$d_2 = \frac{2a}{\sqrt{h^2 + k^2 + l^2}}$$



# References

- <https://images.app.goo.gl/xbQ6Xkw1hPVmZAMt6>
- <https://images.app.goo.gl/muWdeRoypoVAr5Ku8>
- <https://images.app.goo.gl/7Tof1DRmaw9vNKG58>

*Thank You*