Miller Indices for planes

Thapar Institute of Engineering & Technology
(Deemed to be University)
Bhadson Road, Patiala, Punjab, Pin-147004
Contact No. : +91-175-2393201
Email : info@thapar.edu

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OF ENGINEERING & TECHNOLOGY
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Miller indices for planes

Procedure when plane is given

1. Choose origin
2. Find intercepts on the respective axis
3. Take reciprocal
4. Clear fractions
5. Enclose in ()

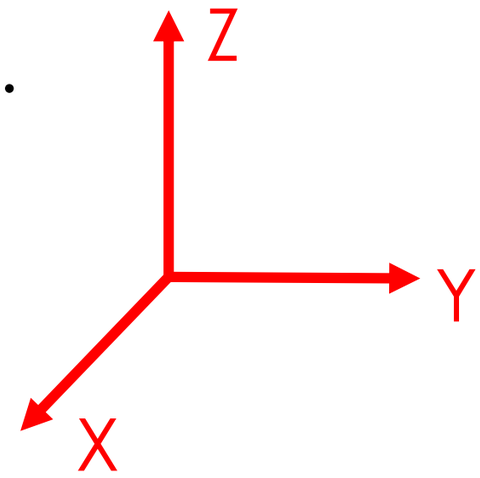
Remember

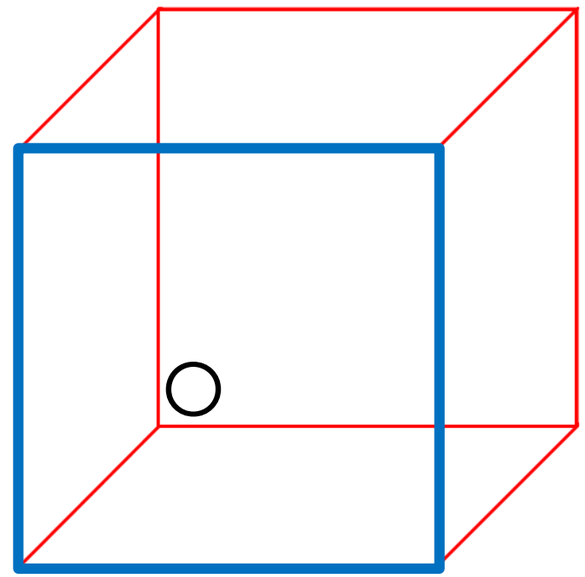
- Atom is in 0-D
- Direction is in 1-D
- Plane is in 2-D
- Crystal is in 3-D

- A plane cannot pass through the origin
- If such as case arises, either shift the plane or shift the origin

MI for planes

Find out MI for the given plane.

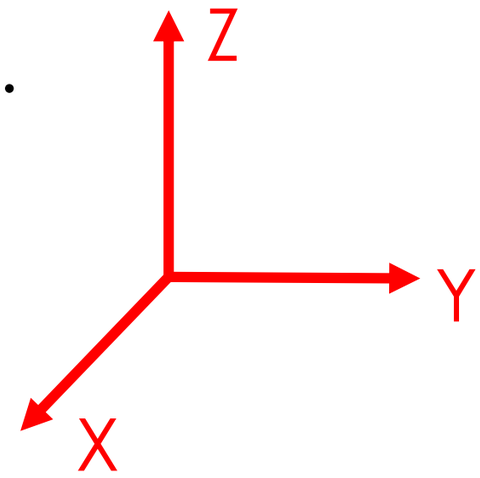


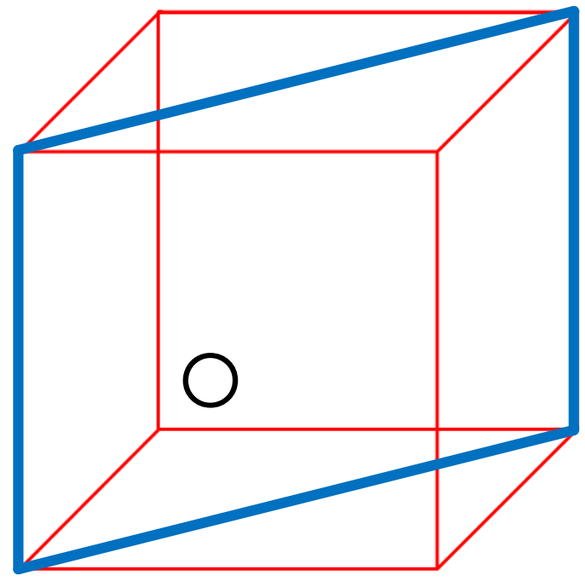


1	Choose origin	Y
2	Find intercepts on the respective axis	1,∞,∞
3	Take reciprocal	1,0,0
4	Clear fractions	--
5	Enclose in ()	(100)

MI for planes

Find out MI for the given plane.

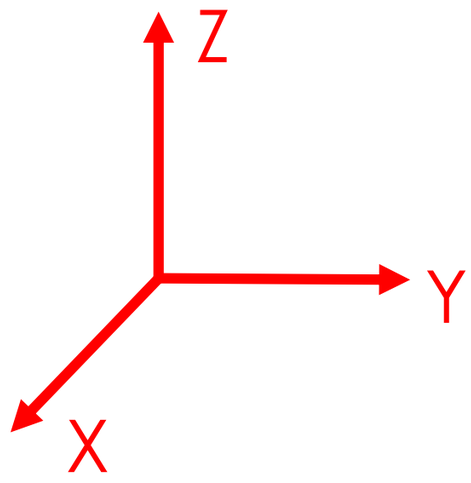


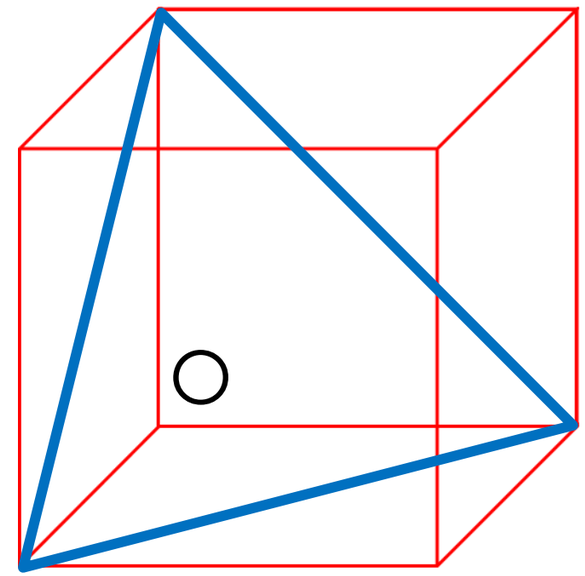


1	Choose origin	Y
2	Find intercepts on the respective axis	1,1,∞
3	Take reciprocal	1,1,0
4	Clear fractions	--
5	Enclose in ()	(110)

MI for planes

Find out MI for the given plane.

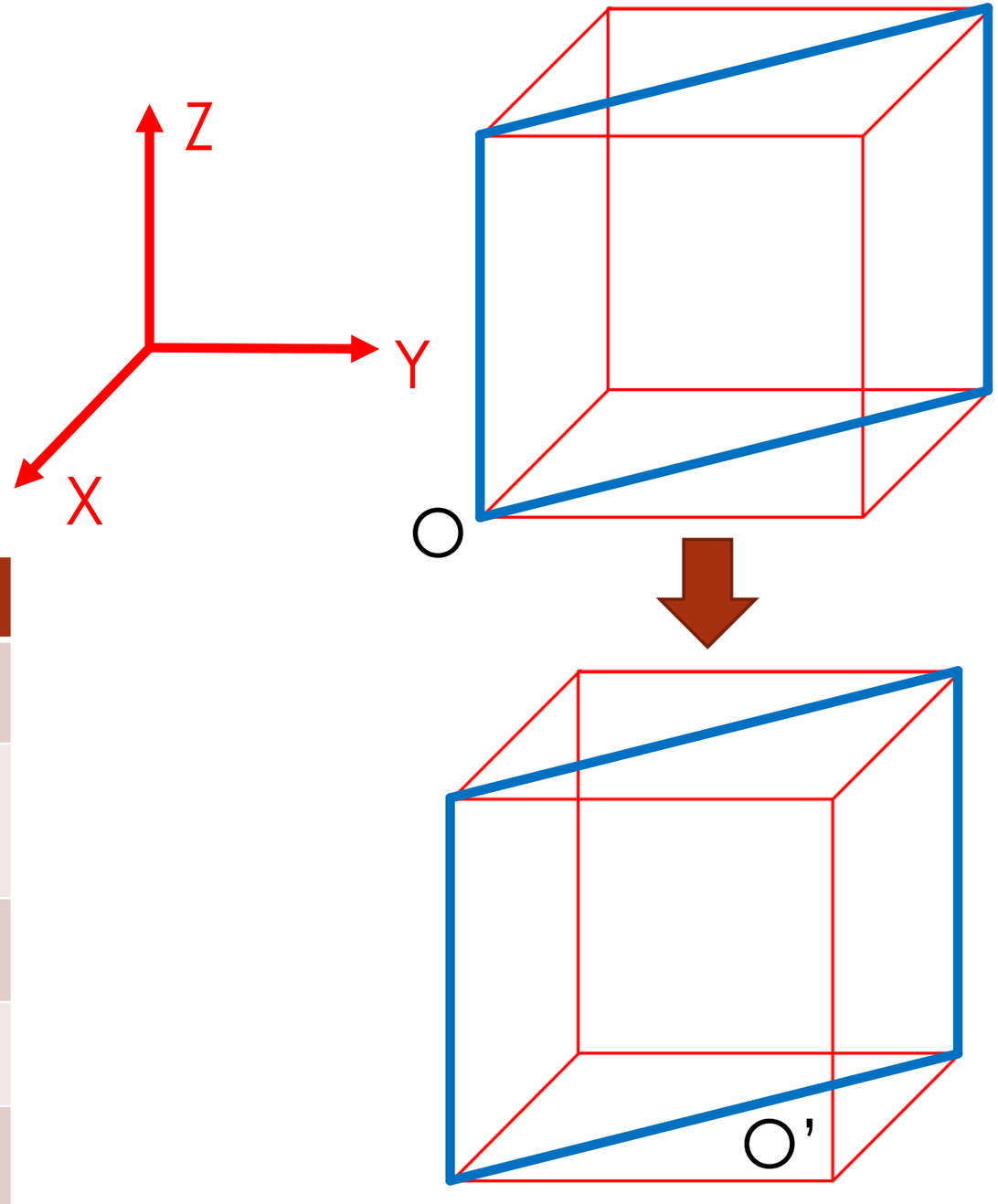




1	Choose origin	Y
2	Find intercepts on the respective axis	1,1,1
3	Take reciprocal	1,1,1
4	Clear fractions	--
5	Enclose in ()	(111)

MI for planes

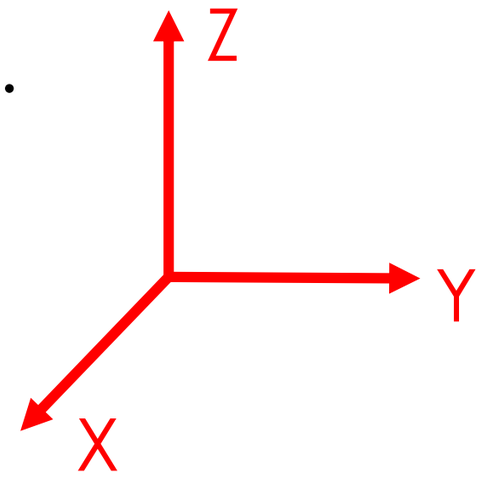
Find out MI for the given plane.

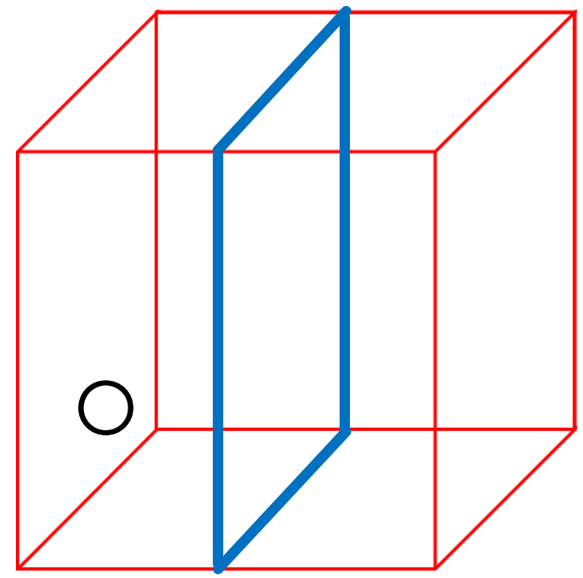


1	Choose origin	Y
2	Find intercepts on the respective axis	-1,-1, ∞
3	Take reciprocal	-1,-1, 0
4	Clear fractions	--
5	Enclose in ()	$(\bar{1}\bar{1}0)$

MI for planes

Find out MI for the given plane.





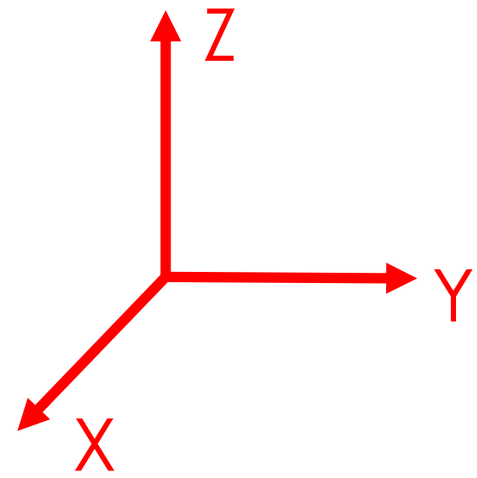
1	Choose origin	Y
2	Find intercepts on the respective axis	∞,1/2,∞
3	Take reciprocal	0,2,0
4	Clear fractions	--
5	Enclose in ()	(020)

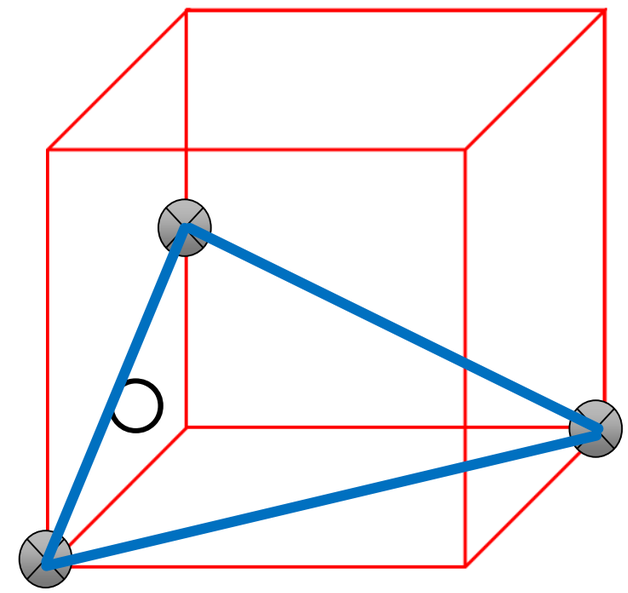
Procedure when MI is given

1. Choose origin
2. Take reciprocal of the MI given
3. Mark the intercepts on respective axis
4. Join the intercepts

MI for planes

Draw (112) plane

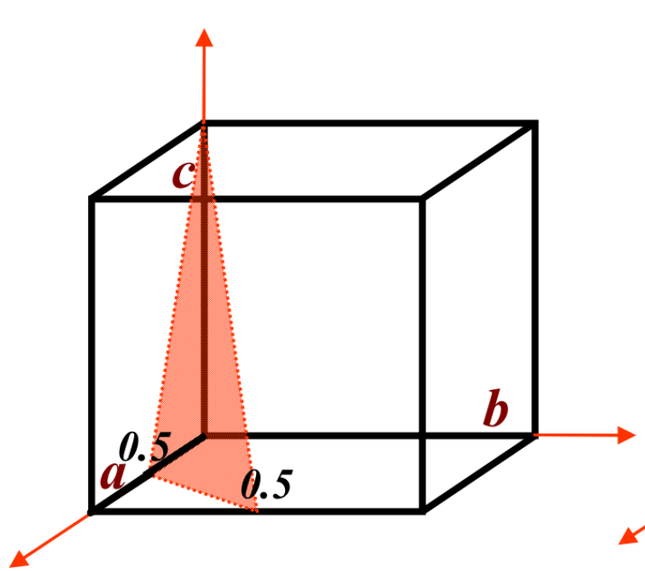


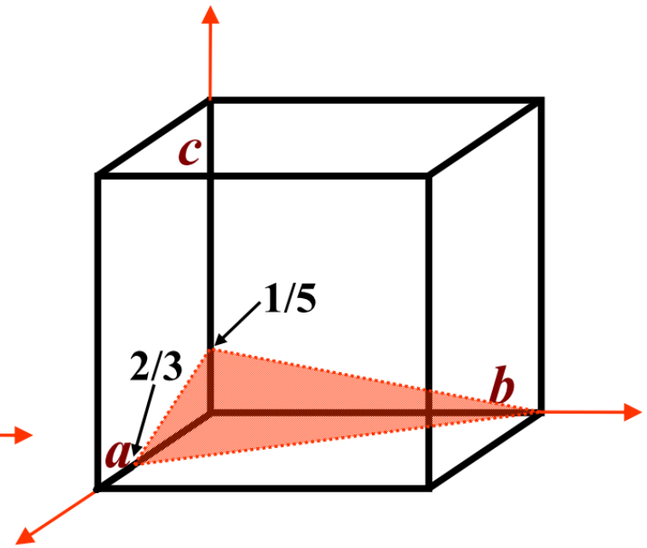


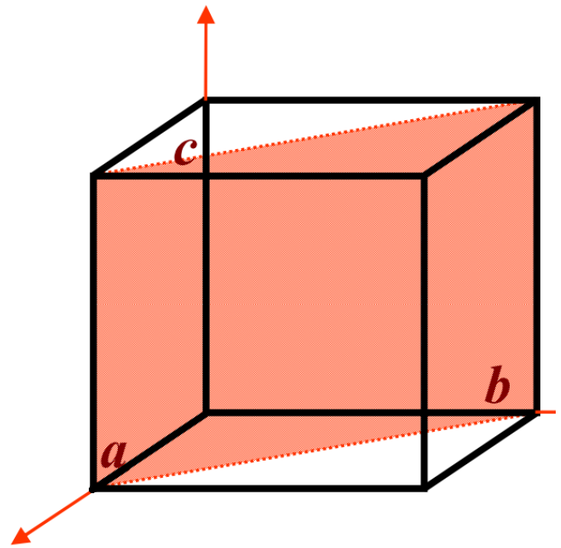
1	Choose origin	Y
2	Take reciprocal of the MI given	1, 1, 1/2
3	Mark the intercepts on respective axis	Y
4	Join the intercepts	--

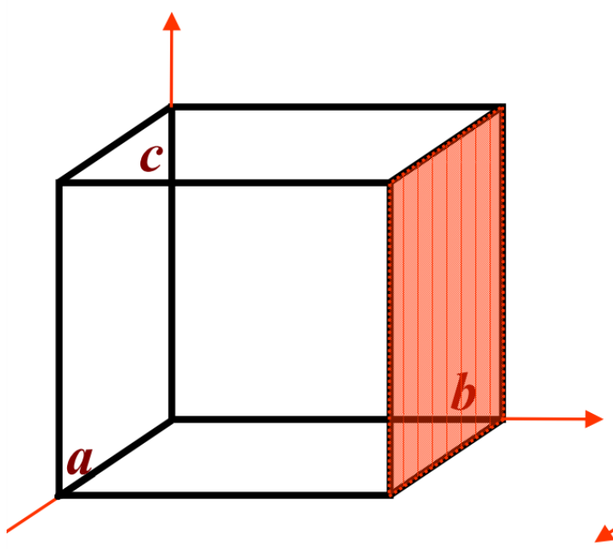
MI for planes

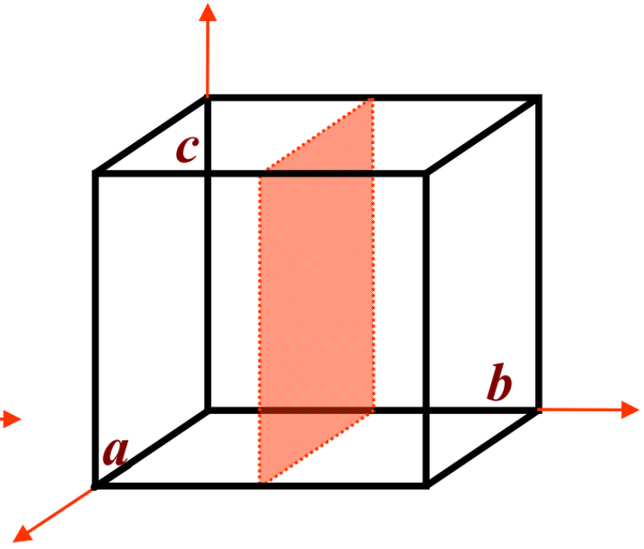
Practice yourself

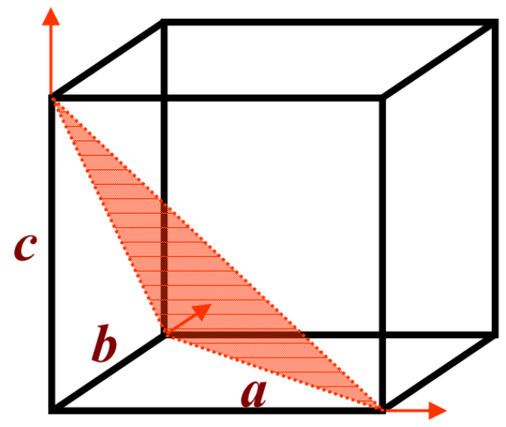




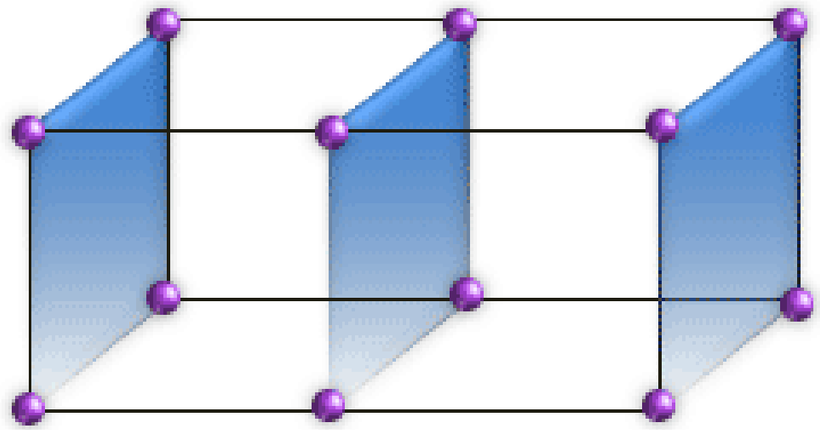




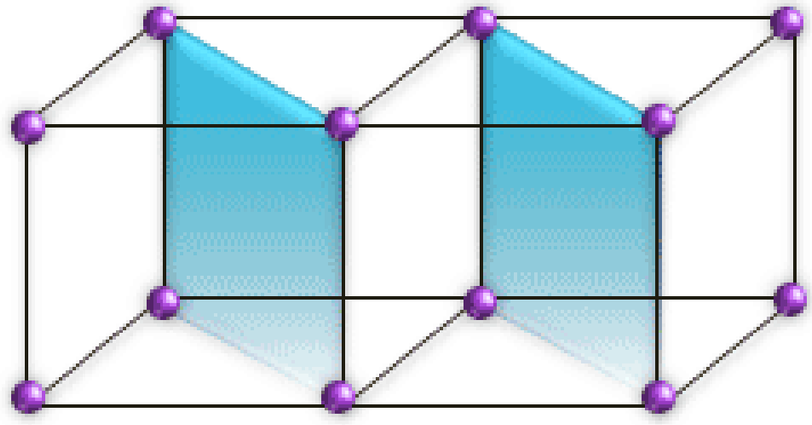




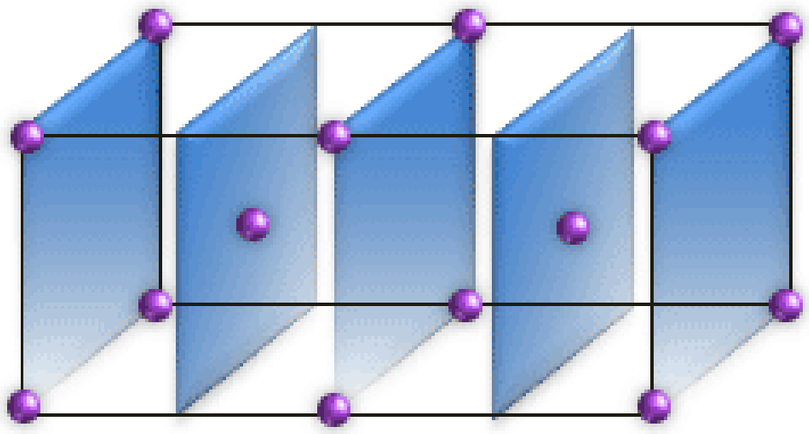
Set of identical parallel planes



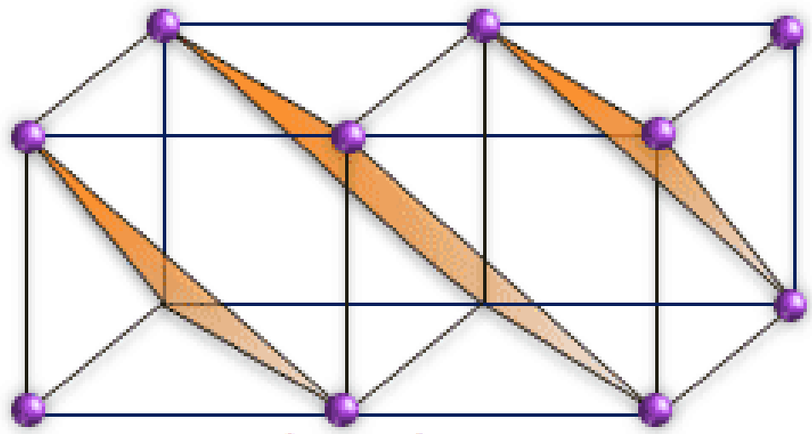
(1 0 0)
Simple Cubic Crystal



(1 1 0)
Simple Cubic Crystal



(2 0 0)
Body centered Cubic Crystal



(1 1 1)
Simple Cubic Crystal

Distance between the planes

Two parallel planes are identical and the distance can by calculated by

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

Lattice parameter

d-spacing (distance between two planes)

Miller indices for that plane

Family of directions and planes

- In a unit cell we can identify certain planes as a group of equivalent planes.
- e.g. (110) is equivalent to (101)
- These are set of crystallographically equivalent planes
- These equivalent group of planes are called as family of planes.
- e.g. {100} family of plane consists following planes

(100), (010), (001),$(\bar{1}00)$, $(0\bar{1}0)$, $(00\bar{1})$

Similarly, find out planes and directions in other family of plane and directions.

Summary

1. In cubic system the direction [uvw] is always perpendicular to the plane(hkl).
2. Identical planes are parallel to each other.
3. A family of planes have same magnitude and identical planes but in opposite directions.

Assignments

1. Draw (100) plane and [100] direction in a single unit cell. Similarly, try for (110) and [110] ,(111) plane and [111] directions and plans as well. Comment on the result.
2. Find out the direction and planes in <100>, <110> and <111> family of directions.
3. Find out the direction and planes in {100}, {110} and {111} family of planes.
4. Draw cubic unit cell and show the following planes in it

(a) $(21\bar{2})$ (b) $(1\bar{2}0)$ (c) $(12\bar{2})$ (d) $(20\bar{3})$ (e) $(\bar{3}1\bar{2})$ (f) $(2\bar{2}3)$

5. Draw the following crystallographic planes in cubic unit cell:

(a) (101) (b) $(1\bar{1}0)$ (c) (221) (d) (210) (e) $(0\bar{1}2)$