MATERIALS ENGINEERING

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Miller Indices

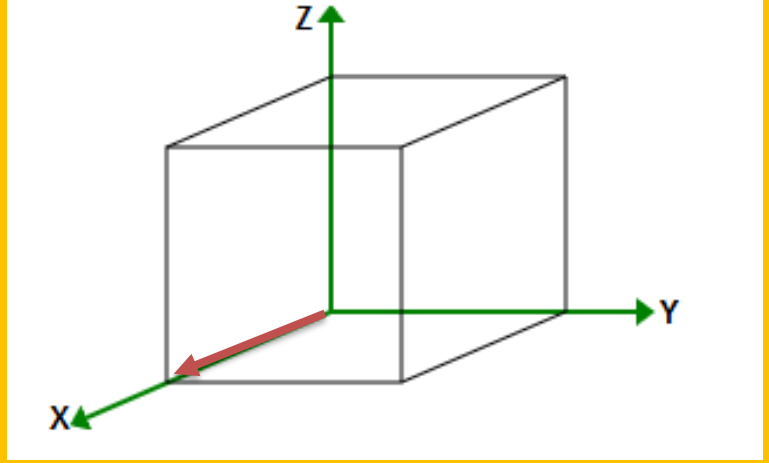
Miller Indices for Directions

- **A vector** of convenient length is positioned such that it passes through th e **origin of the coordinate system**. Any vector *may be translated through out the crystal lattice without alteration*, if parallelism is maintained.

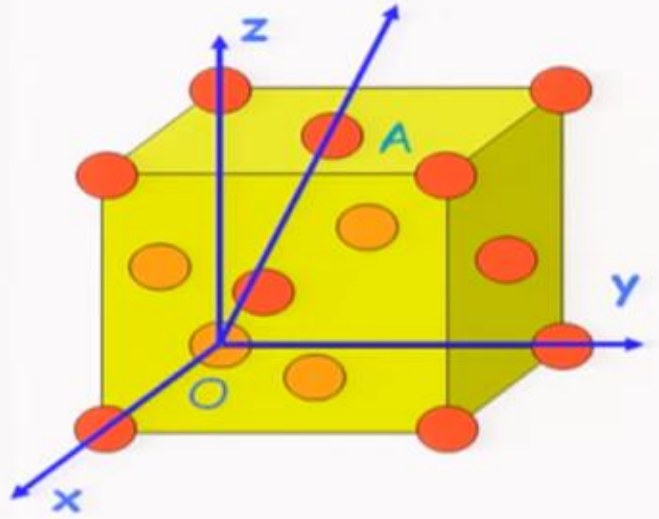
- The length of **the vector projection on each of the three axes** is determi ned; *these are measured in terms of the unit cell dimensions a*, *b*, *and c*.

- These three numbers are multiplied or divided by a common factor to red uce them to the **smallest integer values**

- **The three indices, not separated by commas**, are enclosed in square brac kets, thus: [*uvw*]. The *u*, *v*, and *w* integers correspond to the reduced proje ctions along the *x*, *y*, and *z* axes, respectively



- Choose the origin on the direction
- Choose the co-ordinate system which is parallel to unit cell edges
- Find the point in accordance with a,b,c
- For above example it is 1a+0b+0c
- **1 0 0**
- Reduce the co-ordinate to smallest interger 1 0 0
- Put the numbers in square bracket [1 0 0]



OA=1/2 **a** + 1/2 **b** + 1 **c**

1/2, 1/2, 1

[1 1 2]

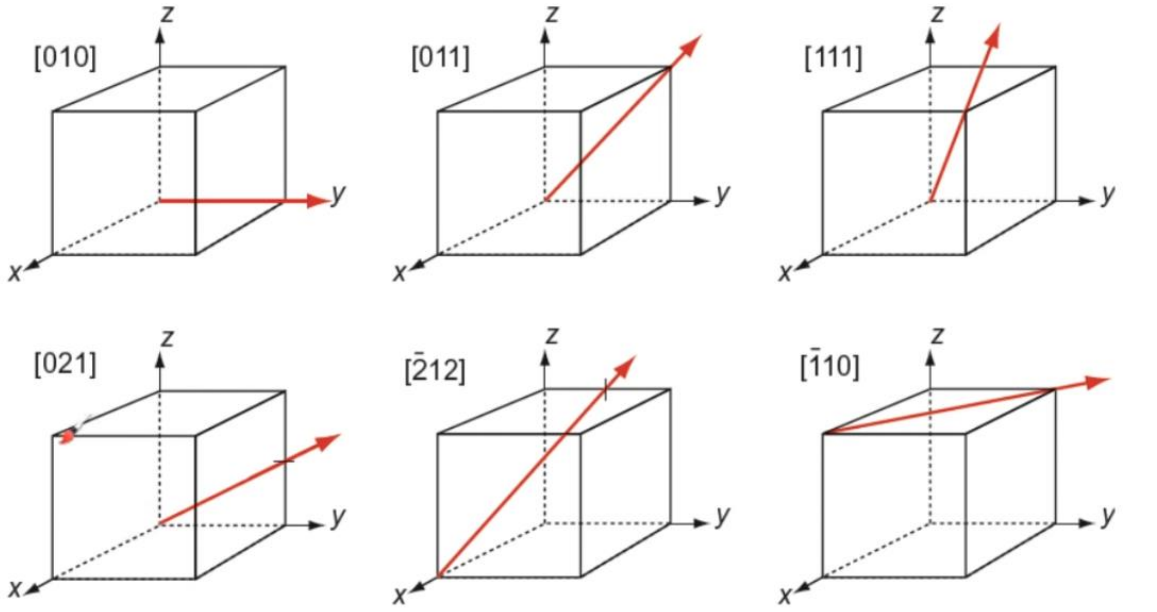
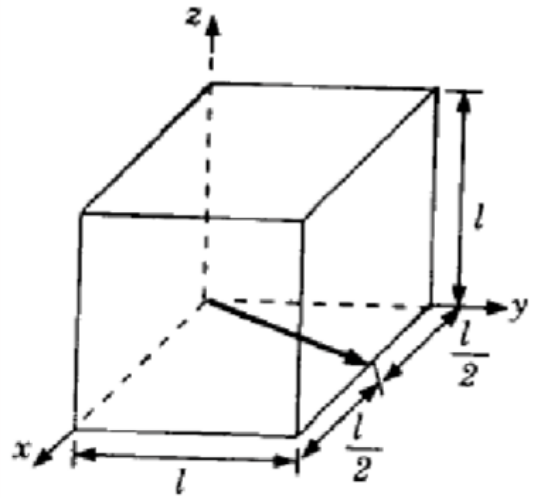


Figure GL1.9 Miller indices of directions. Always translate the direction so that it starts at the origin.

2. A unit cell of a crystal is shown in the given figure. The Miller indices of the direction (arrow) shown in the figure is



(a) [0 1 2]

(b) [0 2 1]

(c) [1 2 0]

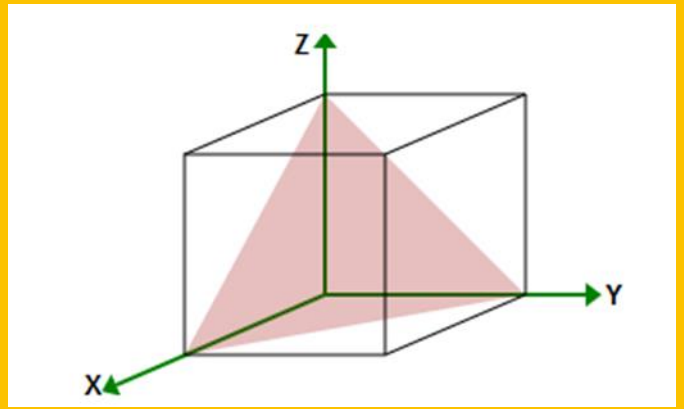
(d) [2 0 1]

Miller Indices for Plane

- The orientations of planes for a crystal structure are represented

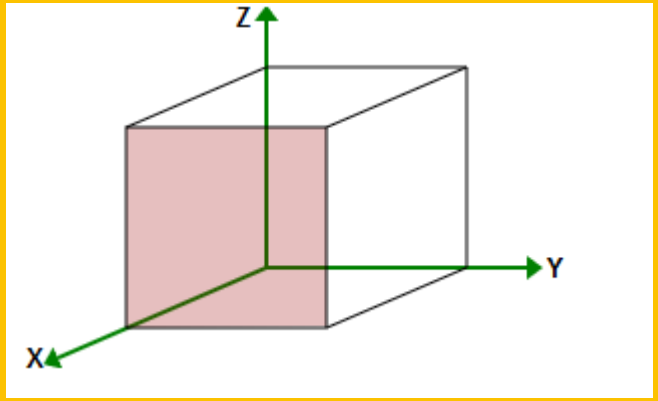
Procedure to find miller indices are as follows

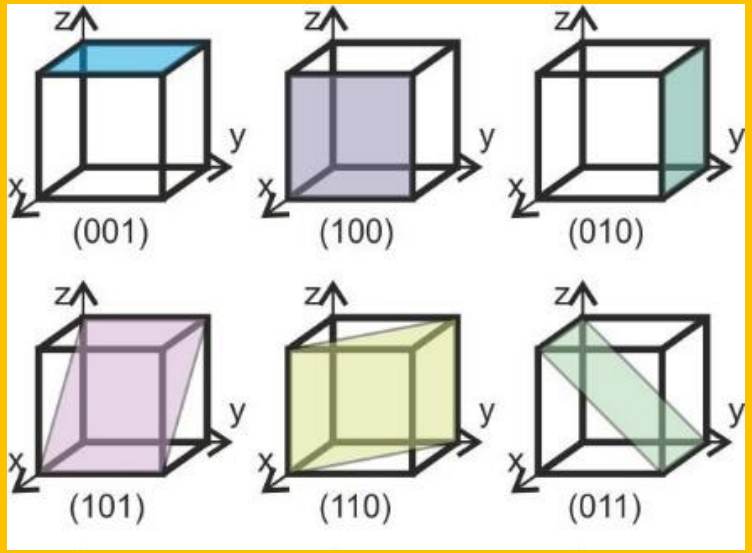
- A co-ordinate system with 3 axis and origin
- Finding the intercept of the plane let call them c1,c2,c3
- They are expressed in terms of axial unit c1=pa ,c2=qb, c=rc
- Take the reciprocal (1/p,1/q,1/r)
- Reduce to integer
- Put in parentheses i.e. ()



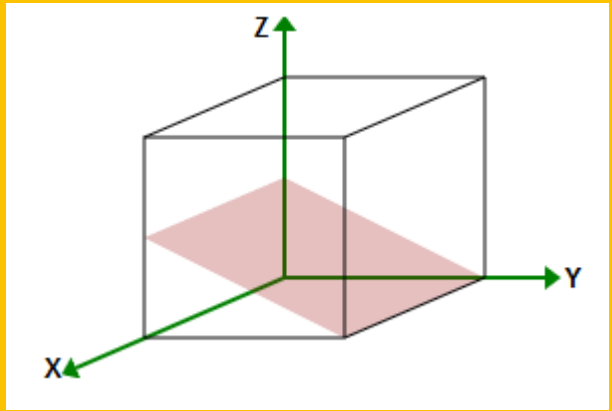
Intercepts
Reciprocals
Reduction
Miller Indices

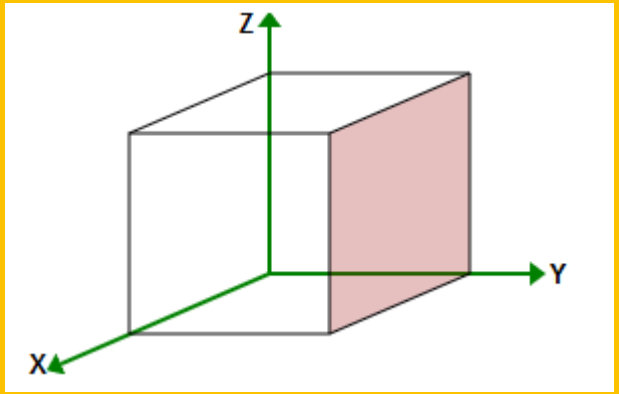
(100)




z
y
x
(001)
(100)
(010)
(101)
(110)
(011)

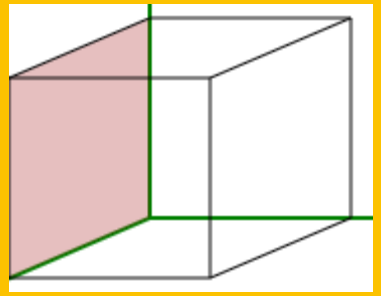
(012)

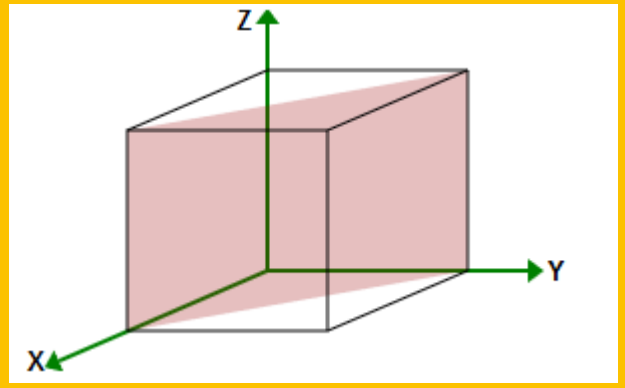




(010)

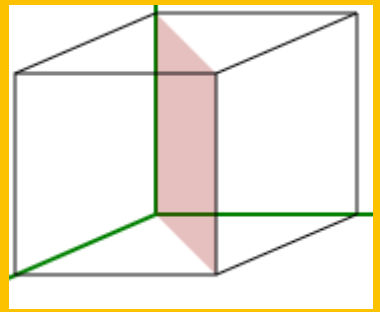
(0$\bar{1}$0)





(110)

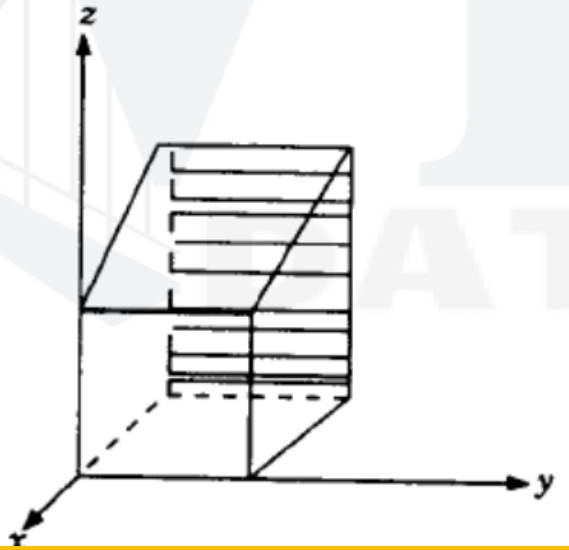
$(1\bar{1}0)$



IES-20. The set of Miller indices of the plane shown in the given figure is **[IES-1999]**

(a) $(\bar{1}\,0\,0)$ (b) $(1\,0\,0)$

(c) $(1\,0\,1)$ (d) $(1\,1\,0)$



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- https://www.youtube.com/watch?v=mc-VocwArHY
- https://www.youtube.com/watch?v=iktLutyh4W8
- http://www.examhill.com/miller-indices/

Thank You