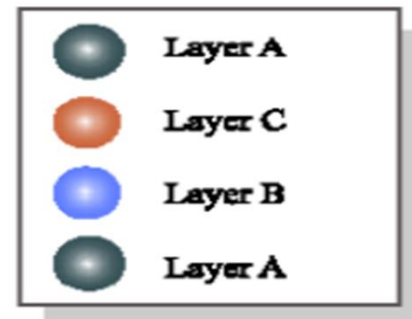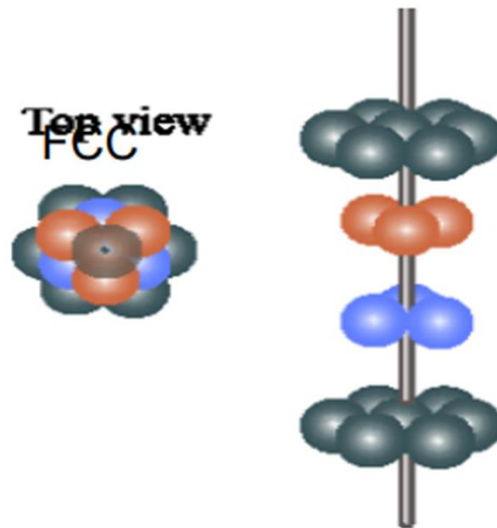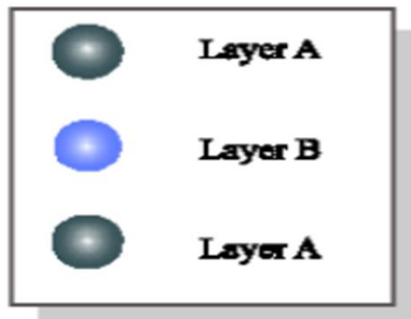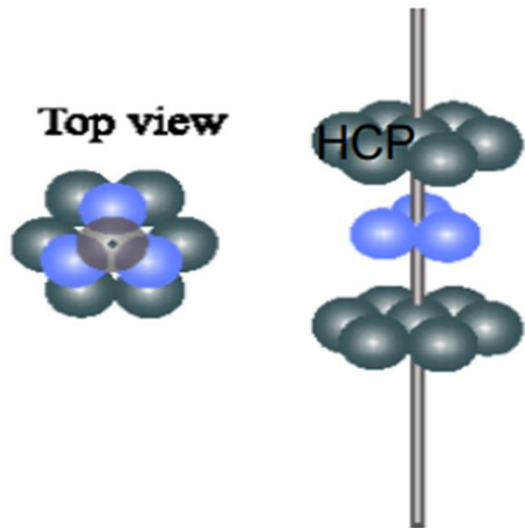# Close Packed Structures
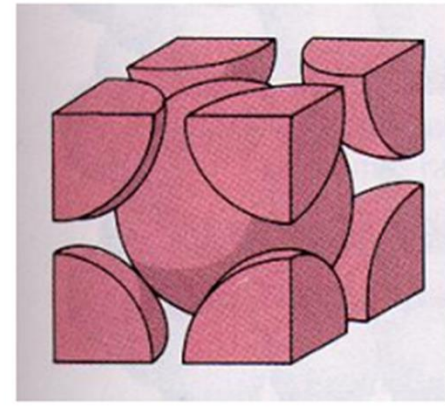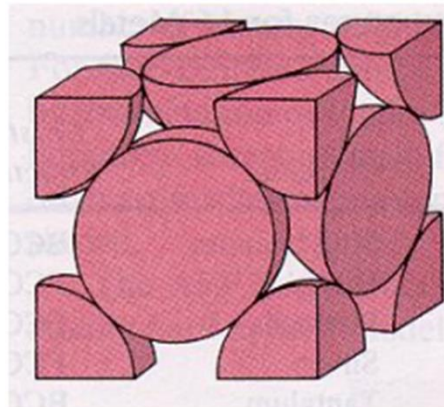
Atomic Packing Factor

- The ratio of atomic sphere volume to unit cell volume, assuming a hard sphere model.

- FCC = HCP = 74% (26% void space in unit cell)

- BCC = 68%

Crystallographic Points, Directions Planes

- Directions
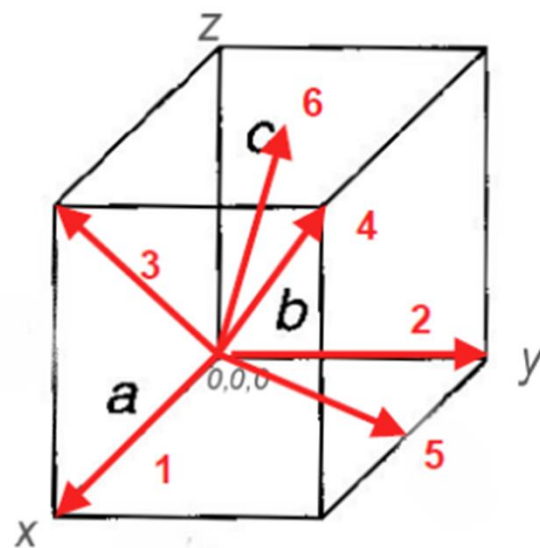
Based on intersection with the cell boundaries
Indicated with underline square brackets [h, k, l]

- Direction 1   1, 0, 0 = [100]
- Direction 2   0, 1, 0 = [010]
- Direction 3   1, 0, 1 = [101]
- Direction 4   1, 1, 1 = [111]
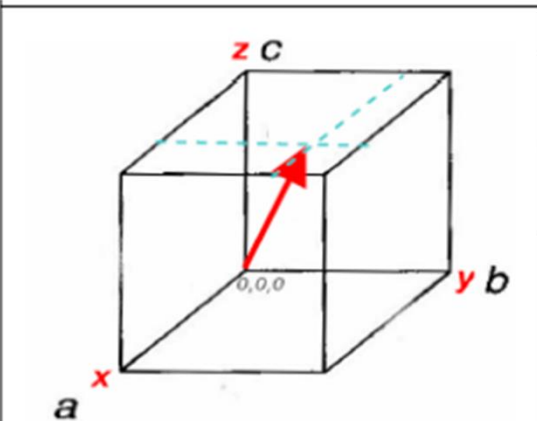- Direction 5   ½, 1, 0 = [120]
- Direction 6   ½, ½, 1 = [112]

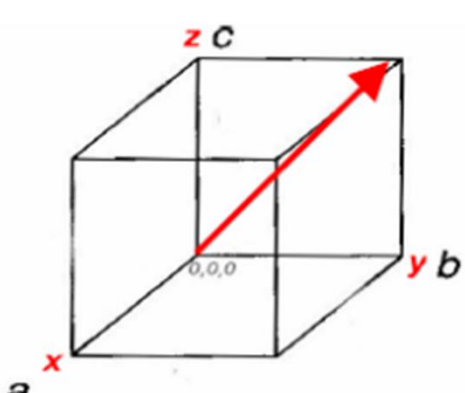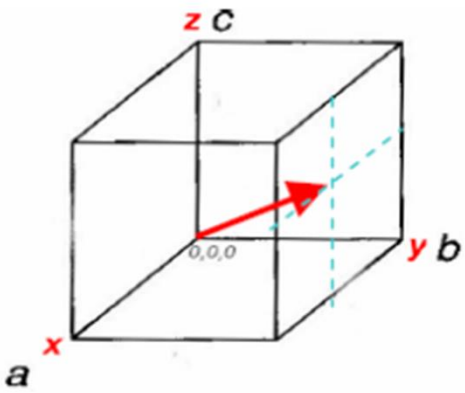-- Parallel directions have the same value
Lowest Integer Value [111] = [222]

Directions Continued

-- **No Fractions, Convert to Integers [½ ½ 1] = [112]**

-- **Negative Direction has a top bar on the hkl value   [1$\bar{1}$1]**

	x (a)	y (b)	z (c)
Point Coordinates	¾	¾	1
Clear Fractions	3	3	4
Crystal Direction	[334]		

Directions Continued

	x (a)	y (b)	z (c)
Point Coordinates	0	1	1
Clear Fractions	0	1	1
Crystal Direction	[011]		

	x (a)	y (b)	z (c)
Point Coordinates	½	1	½
Clear Fractions	1	2	1
Crystal Direction	[121]		

Crystal Planes

Miller Indices-- Based on reciprocal of the intersection of the plane with the cell axes, indicated with <u>parenthesis</u> (*h, k, l*)

- Plane 1 $1/\infty$, $1/1$, $1/\infty$ = (010)

- Plane 2 $1/1$, $1/1$, $1/\infty$ = (110)

- Plane 3 $1/1$, $1/1$, $1/1$ = (111)

- Plane 4 $1/1$, $1/1$, $1/(\frac{1}{2})$ = (112)

- Plane 5 $1/(\frac{1}{2})$, $1/1$, $1/(\frac{3}{4})$ = (634)
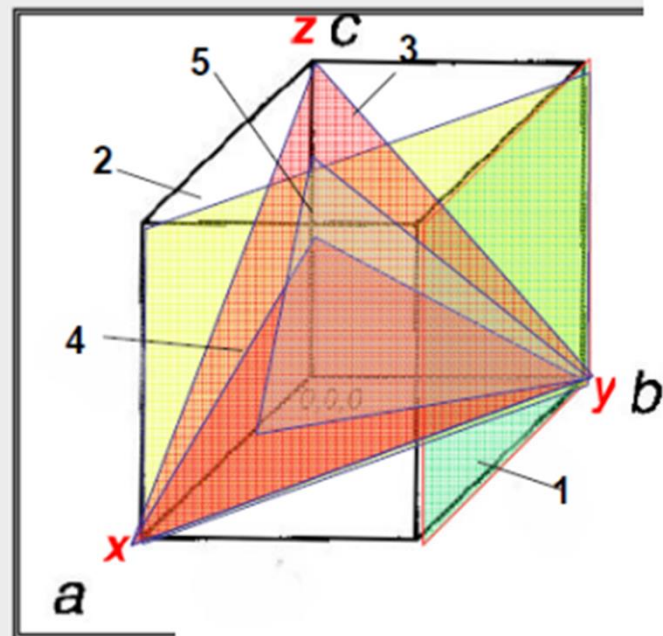
-- Parallel planes have the same value (111) = (222)

-- No Fractions, convert to integers ($\frac{1}{2}$ $\frac{1}{2}$ 1) = (112)

-- Negative Direction has a top bar on the hkl value ($11\bar{1}$)