Answers to selected suggested problems in Chapter 3 (2, 7, 8, 9, 17, 18, 22, 30, 39, 40, 41, 42) Note: 3.40 and 3.41 "Plane A"s are a little unique and I will avoid asking these on exams and homeworks.

Note: The key to some answers are not given since they come from the book; they should be apparent from the chapter text or solutions given in the back of book.

3.2 $V_c = 1.213 \times 10^{-28}\ m^3$

3.7 density = $10.21\ g/cm^3$

3.8 radius = 1.38×10^{-8} cm = 0.138 nm

3.9 radius = 1.43×10^{-8} cm = 0.143 nm

3.17 density = $1.84\ g/cm^3$

3.18 radius = 1.60×10^{-8} cm = 0.160 nm

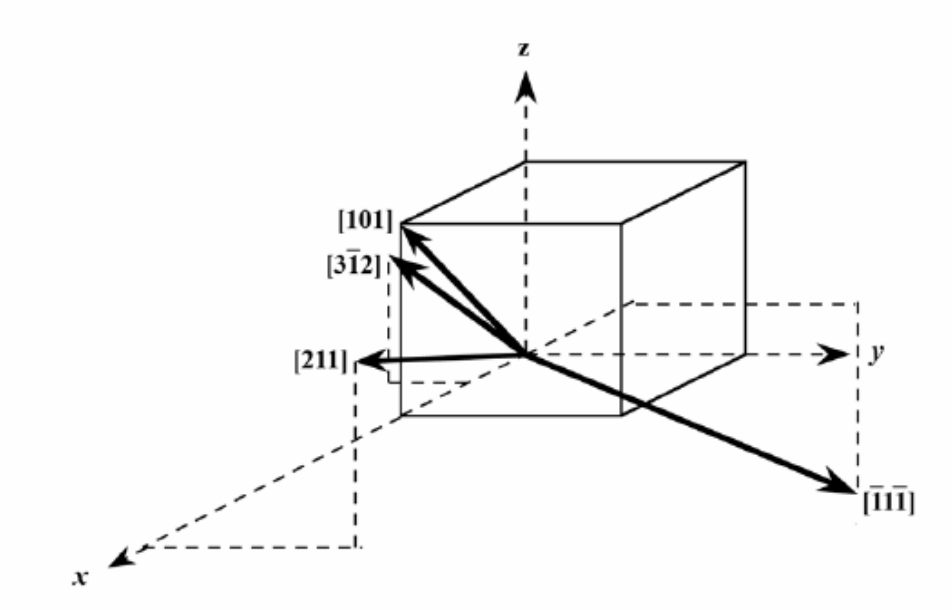
3.22

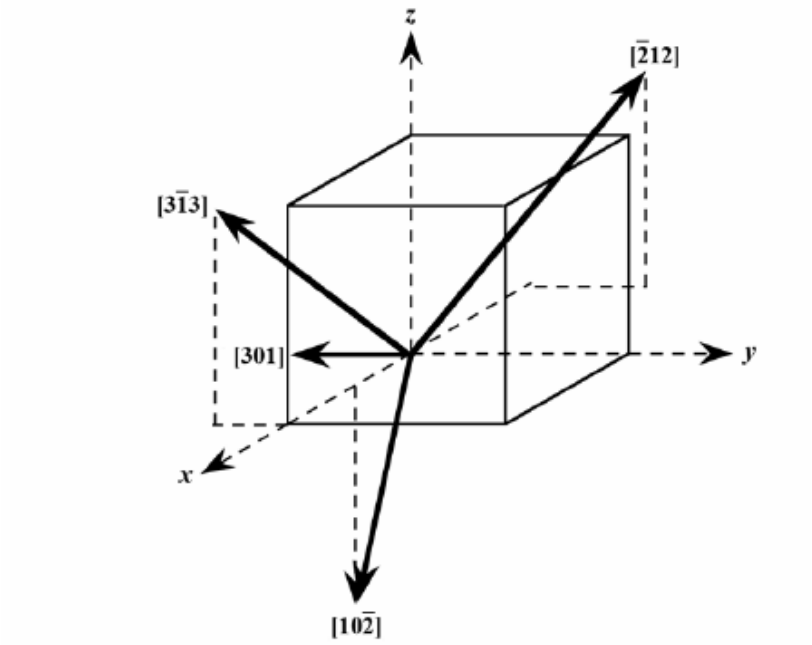
3.22 This problem asks that we list the point coordinates for all of the atoms that are associated with the FCC unit cell. From Figure 3.1b, the atom located of the origin of the unit cell has the coordinates 000. Coordinates for other atoms in the bottom face are 100, 110, 010, and $\frac{1}{2}\frac{1}{2}0$. (The z coordinate for all these points is zero.)

For the top unit cell face, the coordinates are 001, 101, 111, 011, and $\frac{1}{2}\frac{1}{2}1$. (These coordinates are the same as bottom-face coordinates except that the "0" z coordinate has been replaced by a "1".)

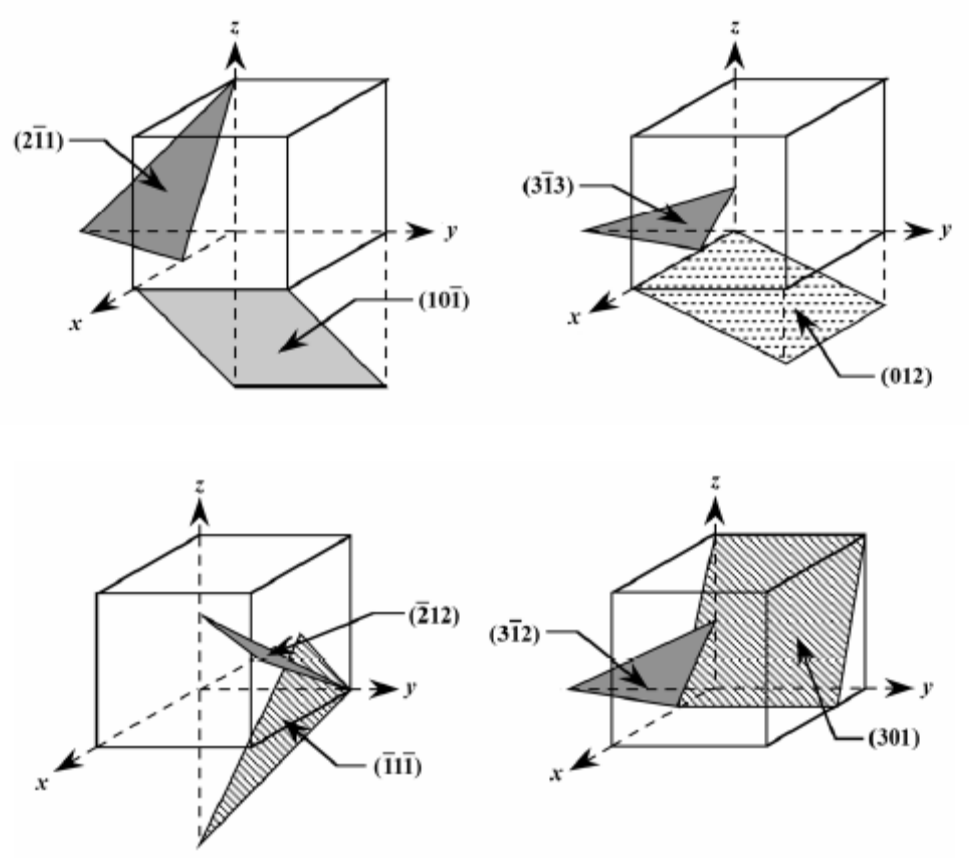
Coordinates for those atoms that are positioned at the centers of both side faces, and centers of both front and back faces need to be specified. For the front and back-center face atoms, the coordinates are $1\frac{1}{2}\frac{1}{2}$ and $0\frac{1}{2}\frac{1}{2}$, respectively. While for the left and right side center-face atoms, the respective coordinates are $\frac{1}{2}0\frac{1}{2}$ and $\frac{1}{2}1\frac{1}{2}$.

3.30


z
[101]
[3$\bar{1}$2]
[211]
y
[$\bar{1}\bar{1}\bar{1}$]
x


z
[$\bar{2}$12]
[3$\bar{1}$3]
[301]
y
x
[10$\bar{2}$]

3.39


z
(2$\bar{1}$1)
y
x
(10$\bar{1}$)
z
(3$\bar{1}$3)
y
x
(012)
z
($\bar{2}$12)
y
x
($\bar{1}\bar{1}\bar{1}$)
z
(3$\bar{1}$2)
y
x
(301)

Note in the explanations below, I am referring to intercepts as "a, b, & c" (corresponding to the x, y, and z-axes) rather than just using "a" as we typically do. This is to distinguish intercepts in the description below.

3.40

Plane A. This one is a little different because of how the plane is hitting the c-edge away from the z-axis.

Plane A: ($\bar{1}\ \bar{1}\ 1$)
The origin may be moved one unit cell distance parallel to x-axis and then one unit cell distance parallel to the y-axis. Thus, the intercepts are -a, -b, and c.

Plane B: (2 3 0)
The axial intercepts are a/2, b/3, and ∞c.

3.41

Plane A. Again, this one is a little different because of how the plane is hitting the a-edge away from the x-axis.

Plane A: ($1\ \bar{1}\ 0$).
The origin is moved one unit cell distance to the right along the y axis. Thus, the axial intercepts are a/2, -b/2, and ∞c. (Note: a "reduction" was necessary here).

Plane B: (1 2 2)
The axial intercepts are a, b/2, and c/2.

3.42

Plane A: ($2\ 1\ \bar{1}$).
Plane passes through origin. So, for instance, the origin could be moved one unit cell "up" along the z-axis. Thus, the intercepts are: a/2, b, and –c.

Plane B: ($0\ 2\ \bar{1}$)
Plane passes through origin. So, for instance, the origin could be moved one unit cell "up" along the z-axis. Thus, the intercepts are: ∞a, b/2, and –c.