3.40 *Sketch within a cubic unit cell the following planes:*

(e) $(\bar{1}1\bar{1})$,

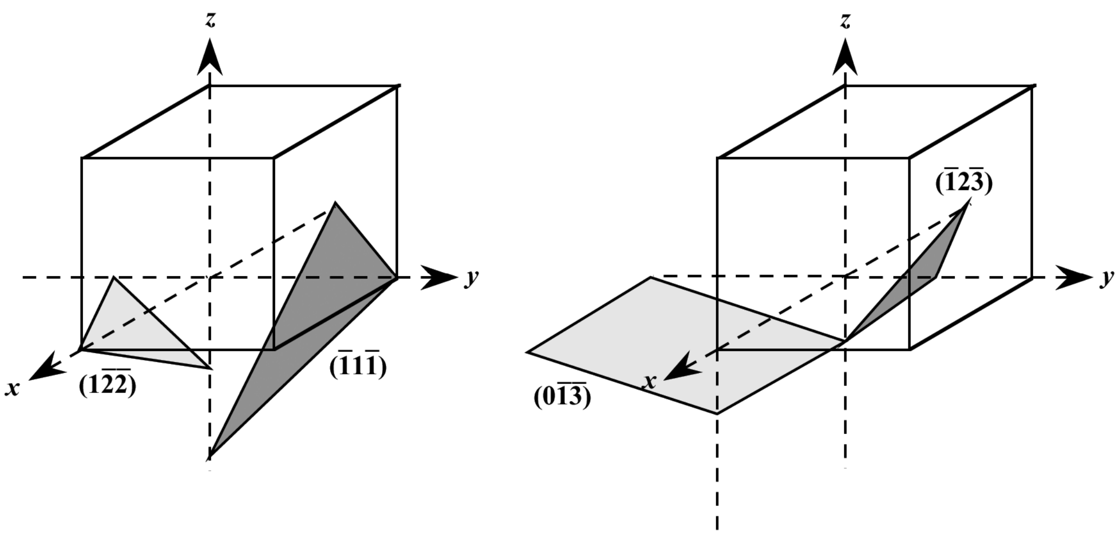
(f) $(1\bar{2}\bar{2})$,

(g) $(\bar{1}2\bar{3})$,

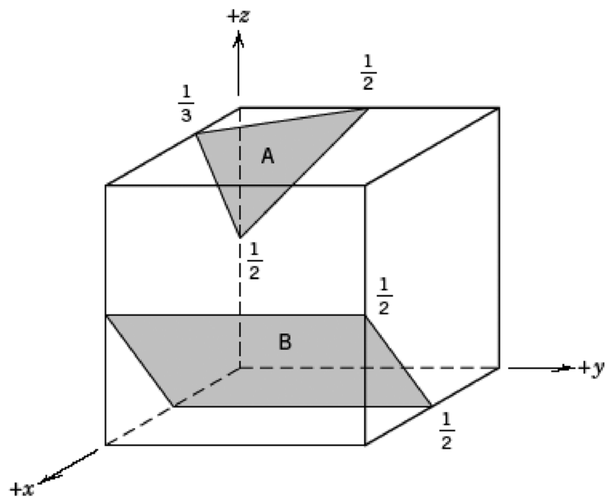
(h) $(0\bar{1}\bar{3})$

Solution

The planes called for are plotted in the cubic unit cells shown below.



3.42 *Determine the Miller indices for the planes shown in the following unit cell:*



Solution

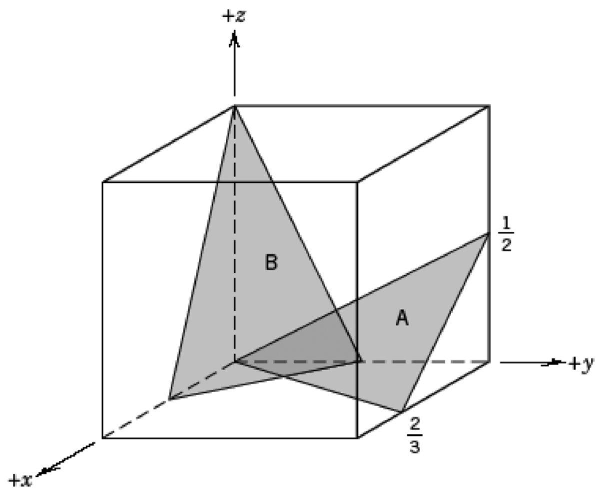
For plane A we will move the origin of the coordinate system one unit cell distance to the upward along the *z* axis; thus, this is a $(32\overline{2})$ plane, as summarized below.

	x	*y*	*z*
Intercepts	$\frac{a}{3}$	$\frac{b}{2}$	$-\frac{c}{2}$
Intercepts in terms of *a*, *b*, and *c*	$\frac{1}{3}$	$\frac{1}{2}$	$-\frac{1}{2}$
Reciprocals of intercepts	3	2	– 2
Reduction		(not necessary)	
Enclosure		$(32\overline{2})$	

For plane B we will move the original of the coordinate system on unit cell distance along the *x* axis; thus, this is a $(\overline{1}01)$ plane, as summarized below.

	x	*y*	*z*
Intercepts	$-\frac{a}{2}$	∞b	$\frac{c}{2}$
Intercepts in terms of *a*, *b*, and *c*	$-\frac{1}{2}$	∞	$\frac{1}{2}$
Reciprocals of intercepts	– 2	0	2
Reduction	– 1	0	1
Enclosure		$(\overline{1}01)$	

3.43 *Determine the Miller indices for the planes shown in the following unit cell:*



<u>Solution</u>

For plane A since the plane passes through the origin of the coordinate system as shown, we will move the origin of the coordinate system one unit cell distance to the right along the *y* axis; thus, this is a $(3\bar{2}4)$ plane, as summarized below.

	$\underline{x}$	$\underline{y}$	$\underline{z}$
Intercepts	$\frac{2a}{3}$	$-b$	$\frac{c}{2}$
Intercepts in terms of *a*, *b*, and *c*	$\frac{2}{3}$	-1	$\frac{1}{2}$
Reciprocals of intercepts	$\frac{3}{2}$	-1	2
Reduction	3	-2	4
Enclosure		$(3\bar{2}4)$	

For plane B we will leave the origin at the unit cell as shown; this is a (221) plane, as summarized below.

	$\underline{x}$	$\underline{y}$	$\underline{z}$
Intercepts	$\frac{a}{2}$	$\frac{b}{2}$	c
Intercepts in terms of *a*, *b*, and *c*	$\frac{1}{2}$	$\frac{1}{2}$	1
Reciprocals of intercepts	2	2	1
Reduction		not necessary	
Enclosure		(221)	

4.7 *What is the composition, in atom percent, of an alloy that consists of 30 wt% Zn and 70 wt% Cu?*

Solution

In order to compute composition, in atom percent, of a 30 wt% Zn-70 wt% Cu alloy, we employ Equation 4.6 as

$$C'_{Zn} = \frac{C_{Zn}A_{Cu}}{C_{Zn}A_{Cu} + C_{Cu}A_{Zn}} \times 100$$

$$= \frac{(30)(63.55 \text{ g/mol})}{(30)(63.55 \text{ g/mol}) + (70)(65.41 \text{ g/mol})} \times 100$$

$$= 29.4 \text{ at\%}$$

$$C'_{Cu} = \frac{C_{Cu}A_{Zn}}{C_{Zn}A_{Cu} + C_{Cu}A_{Zn}} \times 100$$

$$= \frac{(70)(65.41 \text{ g/mol})}{(30)(63.55 \text{ g/mol}) + (70)(65.41 \text{ g/mol})} \times 100$$

$$= 70.6 \text{ at\%}$$

4.8 *What is the composition, in weight percent, of an alloy that consists of 6 at% Pb and 94 at% Sn?*

Solution

In order to compute composition, in weight percent, of a 6 at% Pb-94 at% Sn alloy, we employ Equation 4.7 as

$$C_{\mathrm{Pb}} = \frac{C'_{\mathrm{Pb}} A_{\mathrm{Pb}}}{C'_{\mathrm{Pb}} A_{\mathrm{Pb}} + C'_{\mathrm{Sn}} A_{\mathrm{Sn}}} \times 100$$

$$= \frac{(6)(207.2 \text{ g/mol})}{(6)(207.2 \text{ g/mol}) + (94)(118.71 \text{ g/mol})} \times 100$$

$$= 10.0 \text{ wt\%}$$

$$C_{\mathrm{Sn}} = \frac{C'_{\mathrm{Sn}} A_{\mathrm{Sn}}}{C'_{\mathrm{Pb}} A_{\mathrm{Pb}} + C'_{\mathrm{Sn}} A_{\mathrm{Sn}}} \times 100$$

$$= \frac{(94)(118.71 \text{ g/mol})}{(6)(207.2 \text{ g/mol}) + (94)(118.71 \text{ g/mol})} \times 100$$

$$= 90.0 \text{ wt\%}$$