$$\mathbf{a} = (1/V^*)(\mathbf{b}^* \times \mathbf{c}^*) \tag{13-77a}$$

$$\mathbf{b} = (1/V^*)(\mathbf{c}^* \times \mathbf{a}^*) \tag{13-77b}$$

$$\mathbf{c} = (1/V^*)(\mathbf{a}^* \times \mathbf{b}^*) \tag{13-77c}$$

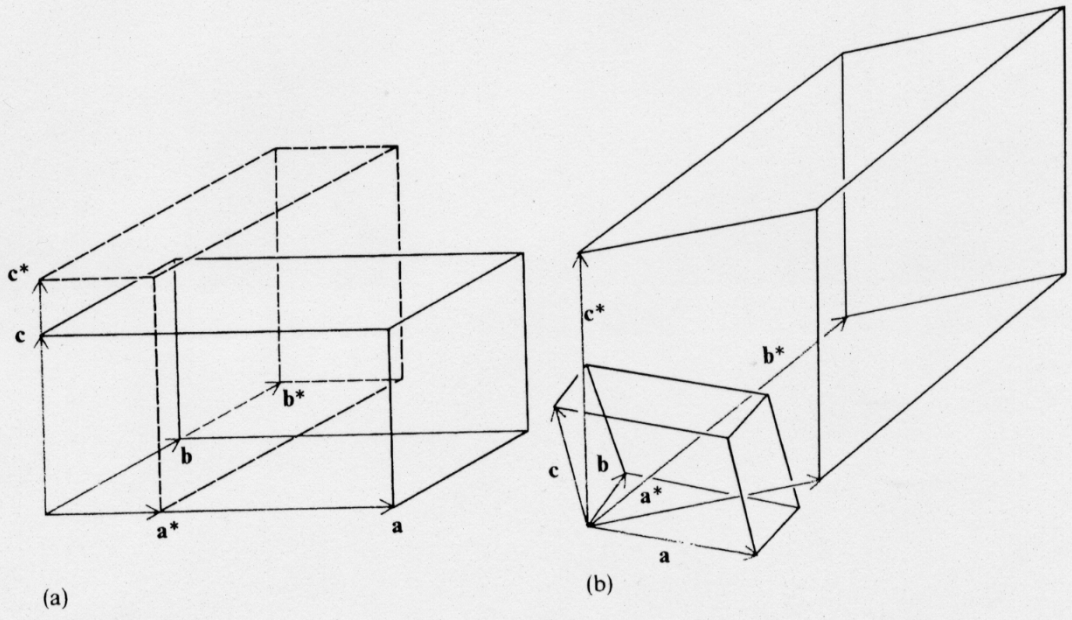

Figure 13-22

Comparisons of direct and reciprocal unit cells. **(a)** For an orthorhombic crystal. **(b)** For a triclinic crystal. [After G. H. Stout and L. M. Jensen, *X-Ray Structure Determination* (New York: Macmillan, 1968).]

Relations between the dimensions of the direct and reciprocal cells

Angular parameters	*Linear parameters*
$\cos\alpha^* = \dfrac{\cos\beta\cos\gamma - \cos\alpha}{\sin\beta\sin\gamma}$	$a^* = \dfrac{bc\sin\alpha}{V}$
$\cos\beta^* = \dfrac{\cos\gamma\cos\alpha - \cos\beta}{\sin\gamma\sin\alpha}$	$b^* = \dfrac{ca\sin\beta}{V}$
$\cos\gamma^* = \dfrac{\cos\alpha\cos\beta - \cos\gamma}{\sin\alpha\sin\beta}$	$c^* = \dfrac{ab\sin\gamma}{V}$
$\cos\alpha = \dfrac{\cos\beta^*\cos\gamma^* - \cos\alpha^*}{\sin\beta^*\sin\gamma^*}$	$a = \dfrac{b^*c^*\sin\alpha^*}{V^*}$
$\cos\beta = \dfrac{\cos\gamma^*\cos\alpha^* - \cos\beta^*}{\sin\gamma^*\sin\alpha^*}$	$b = \dfrac{c^*a^*\sin\beta^*}{V^*}$
$\cos\gamma = \dfrac{\cos\alpha^*\cos\beta^* - \cos\gamma^*}{\sin\alpha^*\sin\beta^*}$	$c = \dfrac{a^*b^*\sin\gamma^*}{V^*}$

Volume

$$V^* = a^*b^*c^*\sqrt{1 - \cos^2\alpha^* - \cos^2\beta^* - \cos^2\gamma^* + 2\cos\alpha^*\cos\beta^*\cos\gamma^*}$$

$$V = abc\sqrt{1 - \cos^2\alpha - \cos^2\beta - \cos^2\gamma + 2\cos\alpha\cos\beta\cos\gamma}$$