Exercise Problem

EX1.2 A plane in a simple cubic crystal is described as a (132) plane. (*a*) What are the intercepts on the $\bar{a}$, $\bar{b}$, and $\bar{c}$ axes. (*b*) Sketch the plane. [$\varsigma = s$ ‘$\zeta = b$ ‘$9 = d$ (*v*) ·su∀]

Three planes that are commonly considered in a cubic crystal are shown shaded in Figure 1.8. The plane in Figure 1.8a is parallel to the $\bar{b}$ and $\bar{c}$ axes so the intercepts are given as $p = 1$, $q = \infty$, and $s = \infty$. Taking the reciprocal, we obtain the Miller indices as (1, 0, 0), so the plane shown in Figure 1.8a is referred to as the (100) plane. Again, any plane parallel to the one shown in Figure 1.8a and separated by an integral number of lattice constants is equivalent and is referred to as the (100) plane. One advantage to taking the reciprocal of the intercepts to obtain the Miller indices is that the use of infinity is avoided when describing a plane that is parallel to an axis. If we were to describe a plane passing through the origin of our system, we would obtain infinity as one or more of the Miller indices after taking the reciprocal of the intercepts. However, the location of the origin of our system is entirely arbitrary and so, by translating the origin to another equivalent lattice point, we can avoid the use of infinity in the set of Miller indices.

For the simple cubic structure, the body-centered cubic, and the face-centered cubic, there is a high degree of symmetry. The axes can be rotated by 90° in each of the three dimensions and each lattice point can again be described by Equation (1.1) as

$$\bar{r} = p\bar{a} + q\bar{b} + s\bar{c} \tag{1.1}$$

Each face plane of the cubic structure shown in Figure 1.8a is entirely equivalent. These planes are grouped together and are referred to as the {100} set of planes.

We may also consider the planes shown in Figures 1.8b and 1.8c. The intercepts of the plane shown in Figure 1.8b are $p = 1$, $q = 1$, and $s = \infty$. The Miller indices

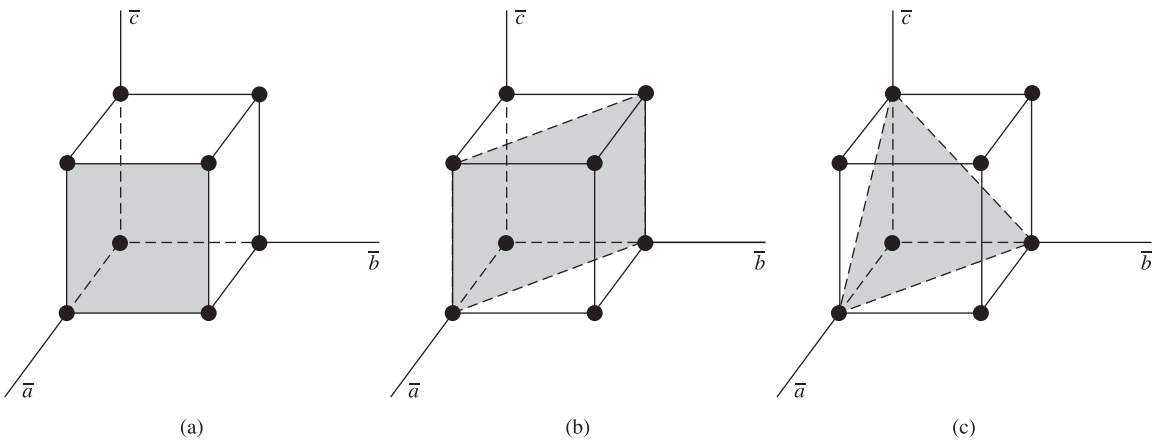

Figure 1.8 | Three lattice planes in a simple cubic lattice: (a) (100) plane, (b) (110) plane, and (c) (111) plane.