TABLE 6.1

Seven Crystal Systems

Crystal System	Axial Lengths and Angles
Cubic	$a = b = c$ $\alpha = \beta = \gamma = 90°$
Tetragonal	$a = b \neq c$ $\alpha = \beta = \gamma = 90°$
Orthorhombic	$a \neq b \neq c$ $\alpha = \beta = \gamma = 90°$
Rhombohedral	$a = b = c$
Trigonal	$\alpha = \beta = \gamma \neq 90°$
Hexagonal	$a = b \neq c$ $\alpha = \beta = 90°\ \gamma = 120°$
Monoclinic	$a \neq b \neq c$ $\alpha = \gamma = 90° \neq \beta$
Triclinic	$a \neq b \neq c$ $\alpha \neq \beta \neq \gamma \neq 90°$

The French crystallographer Bravais proposed 14 possible point lattices, as shown in Figures 6.3 and 6.4, as a result of combining the seven crystal systems and centered points.

Symmetry operations are divided into macroscopic and microscopic operations. Macroscopic operations can be deduced from the arrangement of well-developed crystal faces, without any knowledge of the atomic arrangement inside the crystals, whereas the microscopic operations depend on the atomic arrangement (Table 6.2) that cannot be inferred from the external growth of the crystal. Reflection, rotation, inversion, and rotation–inversion are included in macroscopic operations, whereas glide planes and screw axes belong to microscopic operations. The combination of macroscopic operations with the seven crystal systems leads to 32 possible groups, and they are called 32 point groups. The microscopic symmetry operations describe the way in which the atoms or molecules in crystals are combined to 32 point groups with 14 Bravais lattices, resulting in 230 combinations, called 230 space groups.

A crystalline particle is characterized by definite external and internal structures. Habit describes the external shape of a crystal, whereas polymorphic state refers to the definite arrangement of molecules inside the crystal lattice. Crystallization is invariably employed as the final step for the purification of a solid. The use of different solvents and processing conditions may alter the habit of recrystallized particles, besides modifying the polymorphic state of the solid. Subtle changes in crystal habit at this stage can lead to significant variation in raw-material characteristics. Furthermore, various indices of dosage form performance, such as particle orientation, flowability, packing, compaction, suspension stability, and dissolution can be altered even in the absence of significantly altered polymorphic state. These effects are a result of the physical effect of different crystal habits. In addition, changes in crystal habit either accompanied or not by polymorphic transformation during processing or storage, can lead to serious implications of physical stability in dosage forms. Therefore, in order to minimize the variations in raw-material characteristics, to ensure the reproducibility of results during