14.24 For this problem we are given the density of nylon 6,6 (1.213 g/cm^3), an expression for the volume of its unit cell, and the lattice parameters, and are asked to determine the number of repeat units per unit cell. This computation necessitates the use of Equation 3.5, in which we solve for *n*. Before this can be carried out we must first calculate V_C, the unit cell volume, and *A* the repeat unit molecular weight. For V_C

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

$$= (0.497)(0.547)(1.729)\sqrt{1 - 0.441 - 0.054 - 0.213 + 2(0.664)(0.232)(0.462)}$$

$$= 0.3098 \text{ nm}^3 = 3.098 \text{ x } 10^{-22} \text{ cm}^3$$

The repeat unit for nylon 6,6 is shown in Table 14.3, from which the value of *A* may be determined as follows:

$$A = 12(A_C) + 22(A_H) + 2(A_O) + 2(A_N)$$

$$= 12(12.01 \text{ g/mol}) + 22(1.008 \text{ g/mol}) + 2(16.00 \text{ g/mol}) + 2(14.01 \text{ g/mol})$$

$$= 226.32 \text{ g/mol}$$

Finally, solving for *n* from Equation 3.5 leads to

$$n = \frac{\rho V_C N_A}{A}$$

$$= \frac{(1.213 \text{ g/cm}^3)(3.098 \text{ x } 10^{-22} \text{ cm}^3/\text{unit cell})(6.023 \text{ x } 10^{23} \text{ repeat units/mol})}{226.32 \text{ g/mol}}$$

$$= 1 \text{ repeat unit/unit cell}$$