3.14 For each of these three alloys we need, by trial and error, to calculate the density using Equation 3.5, and compare it to the value cited in the problem. For SC, BCC, and FCC crystal structures, the respective values of n are 1, 2, and 4, whereas the expressions for a (since $V_C = a^3$) are $2R$, $2R\sqrt{2}$, and $\dfrac{4R}{\sqrt{3}}$.

For alloy A, let us calculate ρ assuming a BCC crystal structure.

$$\rho = \frac{nA_A}{V_C N_A}$$

$$= \frac{nA_A}{\left(\dfrac{4R}{\sqrt{3}}\right)^3 N_A}$$

$$= \frac{(2 \text{ atoms/unit cell})(43.1 \text{ g/mol})}{\left\{\left[\dfrac{(4)(1.22 \times 10^{-8} \text{ cm})}{\sqrt{3}}\right]^3 /(\text{unit cell})\right\}(6.023 \times 10^{23} \text{ atoms/mol})}$$

$$= 6.40 \text{ g/cm}^3$$

Therefore, its crystal structure is BCC.

For alloy B, let us calculate ρ assuming a simple cubic crystal structure.

$$\rho = \frac{nA_B}{(2a)^3 N_A}$$

$$= \frac{(1 \text{ atom/unit cell})(184.4 \text{ g/mol})}{\left\{\left[(2)(1.46 \times 10^{-8} \text{ cm})\right]^3 /(\text{unit cell})\right\}(6.023 \times 10^{23} \text{ atoms/mol})}$$

$$= 12.3 \text{ g/cm}^3$$

Therefore, its crystal structure is simple cubic.

For alloy C, let us calculate ρ assuming a BCC crystal structure.