

4.24 This problem asks us to determine the weight percent of Ge that must be added to Si such that the resultant alloy will contain 2.43×10^{21} Ge atoms per cubic centimeter. To solve this problem, employment of Equation 4.19 is necessary, using the following values:

$$N_1 = N_{\text{Ge}} = 2.43 \times 10^{21} \text{ atoms/cm}^3$$

$$\rho_1 = \rho_{\text{Ge}} = 5.32 \text{ g/cm}^3$$

$$\rho_2 = \rho_{\text{Si}} = 2.33 \text{ g/cm}^3$$

$$A_1 = A_{\text{Ge}} = 72.64 \text{ g/mol}$$

$$A_2 = A_{\text{Si}} = 28.09 \text{ g/mol}$$

Thus

$$C_{\text{Ge}} = \frac{100}{1 + \frac{N_{\text{A}} \rho_{\text{Si}}}{N_{\text{Ge}} A_{\text{Ge}}} - \frac{\rho_{\text{Si}}}{\rho_{\text{Ge}}}}$$

$$= \frac{100}{1 + \frac{(6.023 \times 10^{23} \text{ atoms/mol})(2.33 \text{ g/cm}^3)}{(2.43 \times 10^{21} \text{ atoms/cm}^3)(72.64 \text{ g/mol})} - \left(\frac{2.33 \text{ g/cm}^3}{5.32 \text{ g/cm}^3}\right)}$$

$$= 11.7 \text{ wt\%}$$