

4.11 In this problem we are asked to determine the concentrations, in atom percent, of the Ag-Au-Cu alloy. It is first necessary to convert the amounts of Ag, Au, and Cu into grams.

$$m'_{\text{Ag}} = (44.5 \text{ lb}_m)(453.6 \text{ g/lb}_m) = 20,185 \text{ g}$$

$$m'_{\text{Au}} = (83.7 \text{ lb}_m)(453.6 \text{ g/lb}_m) = 37,966 \text{ g}$$

$$m'_{\text{Cu}} = (5.3 \text{ lb}_m)(453.6 \text{ g/lb}_m) = 2,404 \text{ g}$$

These masses must next be converted into moles (Equation 4.4), as

$$n_{m_{\text{Ag}}} = \frac{m'_{\text{Ag}}}{A_{\text{Ag}}} = \frac{20,185 \text{ g}}{107.87 \text{ g/mol}} = 187.1 \text{ mol}$$

$$n_{m_{\text{Au}}} = \frac{37,966 \text{ g}}{196.97 \text{ g/mol}} = 192.8 \text{ mol}$$

$$n_{m_{\text{Cu}}} = \frac{2,404 \text{ g}}{63.55 \text{ g/mol}} = 37.8 \text{ mol}$$

Now, employment of a modified form of Equation 4.5, gives

$$\begin{aligned} C'_{\text{Ag}} &= \frac{n_{m_{\text{Ag}}}}{n_{m_{\text{Ag}}} + n_{m_{\text{Au}}} + n_{m_{\text{Cu}}}} \times 100 \\ &= \frac{187.1 \text{ mol}}{187.1 \text{ mol} + 192.8 \text{ mol} + 37.8 \text{ mol}} \times 100 = 44.8 \text{ at\%} \end{aligned}$$

$$C'_{\text{Au}} = \frac{192.8 \text{ mol}}{187.1 \text{ mol} + 192.8 \text{ mol} + 37.8 \text{ mol}} \times 100 = 46.2 \text{ at\%}$$

$$C'_{\text{Cu}} = \frac{37.8 \text{ mol}}{187.1 \text{ mol} + 192.8 \text{ mol} + 37.8 \text{ mol}} \times 100 = 9.0 \text{ at\%}$$