$$m_{tot} = m_1 + m_2 \quad [1]$$

The sample also has a gross weight percentage of component A that is designated by y in Figure 1. However, as stated before this sample breaks into two phases that have weight percentages of component A equal to y_1 and y_2. Thus, the conservation of component A allows us to write

$$y m_{tot} = y_1 m_1 + y_2 m_2 \quad [2]$$

Substitution of the expression for m_{tot} from Eq. 1 into Eq. 2 gives

$$y(m_1 + m_2) = y_1 m_1 + y_2 m_2 \quad [3]$$

which rearranges to

$$m_1/m_2 = (y_2 - y)/(y - y_1) \quad [4]$$

As seen, the weights of the two phases are in the proportion of the lengths of the tie line segments extending from each side of the sample point. Another way to write this relation is

$$m_1 = m_{tot}[b/(a + b)] \quad [5]$$

$$m_2 = m_{tot}[a/(a + b)] \quad [6]$$

where a and b are the lengths, as shown in Figure 1 [i.e., $(y - y_1)$ and $(y_2 - y)$], respectively. To continue with the example for the point circled in Figure 1, if the total weight of the sample was 5 g, then liquid layer 1 (85% A, 15% B) would weigh 1.54 g, whereas liquid layer 2 (20% A, 80% B) would weigh 3.46 g.

For the diagram shown in Figure 1, as the temperature is raised, the tie lines become shorter because the solubility of each component in the other is increasing. Ultimately, the tie line becomes a point as it crosses the upper portion of the phase boundary. This point could also be considered the point at which the A-in-B solubility boundary joins the B-in-A solubility boundary. A sample having this composition will consist of two roughly equal-volume phases below the upper consult boundary. When heated sufficiently to reach the "critical" point, the interface between the two liquid phases will disappear, and a single-phase liquid will result. Upper critical points, lower critical points, or both upper and lower critical points can occur for binary liquid systems. In systems in