

## Calculation of Isotopic Abundances

### Problem 2-44

What are the percent natural abundances of the two naturally occurring isotopes of boron,  $^{10}\text{B}$  and  $^{11}\text{B}$ ? These isotopes have masses of 10.012937 u and 11.009305 u, respectively.

### Solution

Weighted-average atomic mass = WAAM

$$\text{WAAM} = \text{abund}_1 \times \text{AM}_1 + \text{abund}_2 \times \text{AM}_2$$

$$\text{abund}_1 + \text{abund}_2 = 1$$

$$\text{abund}_2 = 1 - \text{abund}_1$$

The WAAM for boron is 10.811 u (from the periodic table)

$$10.811 \text{ u} = \text{abund}_1 \times 10.012937 \text{ u} + \text{abund}_2 \times 11.009305 \text{ u}$$

$$= \text{abund}_1 \times 10.012937 \text{ u} + (1 - \text{abund}_1) \times 11.009305 \text{ u}$$

$$= \text{abund}_1 \times 10.012937 \text{ u} + 11.009305 \text{ u} - \text{abund}_1 \times 11.009305 \text{ u}$$

$$-0.198305 \text{ u} = \text{abund}_1 \times 10.012937 \text{ u} - \text{abund}_1 \times 11.009305 \text{ u}$$

$$= -0.996368 \times \text{abund}_1$$

$$\text{abund}_1 = 0.19903 \quad (= 19.903\% \text{ } ^{10}\text{B})$$

$$\text{abund}_2 = 1 - 0.19903 = 0.80097 \quad (= 80.097\% \text{ } ^{11}\text{B})$$