The mass percentage of an element in a compound is the same regardless of the sample's size. Therefore, a simpler way to calculate the percentage of an element in a compound is to determine how many grams of the element are present in one mole of the compound. Then divide this value by the molar mass of the compound and multiply by 100.

$$\frac{\text{mass of element in 1 mol of compound}}{\text{molar mass of compound}} \times 100 = \%\ \text{element in compound}$$

The percentage by mass of each element in a compound is known as the **percentage composition** *of the compound.*

SAMPLE PROBLEM J

For more help, go to the Math Tutor at the end of this chapter.

Find the percentage composition of copper(I) sulfide, Cu_2S.

SOLUTION

1 ANALYZE

Given: formula, Cu_2S
Unknown: percentage composition of Cu_2S

2 PLAN

formula ⟶ molar mass ⟶ mass percentage of each element

The molar mass of the compound must be found. Then the mass of each element present in one mole of the compound is used to calculate the mass percentage of each element.

3 COMPUTE

$$2\ \cancel{\text{mol Cu}} \times \frac{63.55\ \text{g Cu}}{\cancel{\text{mol Cu}}} = 127.1\ \text{g Cu}$$

$$1\ \cancel{\text{mol S}} \times \frac{32.07\ \text{g S}}{\cancel{\text{mol S}}} = 32.07\ \text{g S}$$

$$\text{molar mass of } Cu_2S = 159.2\ \text{g}$$

$$\frac{127.1\ \text{g Cu}}{159.2\ \text{g } Cu_2S} \times 100 = 79.85\%\ \text{Cu}$$

$$\frac{32.07\ \text{g S}}{159.2\ \text{g } Cu_2S} \times 100 = 20.15\%\ \text{S}$$

4 EVALUATE

A good check is to see if the results add up to about 100%. (Because of rounding, the total may not always be exactly 100%.)

SAMPLE PROBLEM K

For more help, go to the Math Tutor at the end of this chapter.

As some salts crystallize from a water solution, they bind water molecules in their crystal structure. Sodium carbonate forms such a *hydrate,* in which 10 water molecules are present for every formula unit of sodium carbonate. Find the mass percentage of water in sodium carbonate decahydrate, $Na_2CO_3 \cdot 10H_2O$, which has a molar mass of 286.19 g/mol.