3 COMPUTE First the molar mass of O_2 must be calculated.

$$2 \text{ mol O} \times \frac{16.00 \text{ g O}}{\text{mol O}} = 32.00 \text{ g (mass of one mole of } O_2)$$

The molar mass of O_2 is therefore 32.00 g/mol. Now do the calculation shown in step 2.

$$2.50 \text{ mol } O_2 \times \frac{32.00 \text{ g } O_2}{\text{mol } O_2} = 80.0 \text{ g } O_2$$

4 EVALUATE The answer is correctly given to three significant figures and is close to an estimated value of 75 g (2.50 mol × 30 g/mol).

To convert a known mass of a compound in grams to an amount in moles, the mass must be divided by the molar mass. Or you can invert the molar mass and multiply so that units are easily canceled.

$$\text{mass in grams} \times \frac{1}{\text{molar mass (g/mol)}} = \text{amount in moles}$$

SAMPLE PROBLEM I

Ibuprofen, $C_{13}H_{18}O_2$, is the active ingredient in many nonprescription pain relievers. Its molar mass is 206.31 g/mol.

a. If the tablets in a bottle contain a total of 33 g of ibuprofen, how many moles of ibuprofen are in the bottle?

b. How many molecules of ibuprofen are in the bottle?

c. What is the total mass in grams of carbon in 33 g of ibuprofen?

SOLUTION

1 ANALYZE

Given: 33 g of $C_{13}H_{18}O_2$, molar mass 206.31 g/mol

Unknown: **a.** moles $C_{13}H_{18}O_2$
b. molecules $C_{13}H_{18}O_2$
c. total mass of C

2 PLAN

a. grams ⟶ moles

To convert mass of ibuprofen in grams to amount of ibuprofen in moles, multiply by the inverted molar mass of $C_{13}H_{18}O_2$.

$$\text{g } C_{13}H_{18}O_2 \times \frac{1 \text{ mol } C_{13}H_{18}O_2}{206.31 \text{ g } C_{13}H_{18}O_2} = \text{mol } C_{13}H_{18}O_2$$

b. moles ⟶ molecules

To find the number of molecules of ibuprofen, multiply amount of $C_{13}H_{18}O_2$ in moles by Avogadro's number.

$$\text{mol } C_{13}H_{18}O_2 \times \frac{6.022 \times 10^{23} \text{ molecules}}{\text{mol}} = \text{molecules } C_{13}H_{18}O_2$$