



FIGURE 1 This is a solution plan for problems in which the given and unknown quantities are expressed in moles.

SAMPLE PROBLEM A

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

In a spacecraft, the carbon dioxide exhaled by astronauts can be removed by its reaction with lithium hydroxide, LiOH, according to the following chemical equation.



How many moles of lithium hydroxide are required to react with 20 mol CO₂, the average amount exhaled by a person each day?

SOLUTION

1 ANALYZE

Given: amount of CO₂ = 20 mol
Unknown: amount of LiOH (mol)

2 PLAN

amount of CO₂ (mol) \longrightarrow amount of LiOH (mol)

This problem requires one conversion factor—the mole ratio of LiOH to CO₂. The mole ratio is obtained from the balanced chemical equation. Because you are given moles of CO₂, select a mole ratio that will cancel mol CO₂ and give you mol LiOH in your final answer. The correct ratio has the following units.

$$\frac{\text{mol LiOH}}{\text{mol CO}_2}$$

This ratio cancels mol CO₂ and gives the units mol LiOH in the answer.

$$\text{mol CO}_2 \times \frac{\text{mol ratio}}{\text{mol CO}_2} = \text{mol LiOH}$$

3 COMPUTE

Substitute the values in the equation in step 2, and compute the answer.

$$20 \text{ mol CO}_2 \times \frac{2 \text{ mol LiOH}}{1 \text{ mol CO}_2} = 40 \text{ mol LiOH}$$

4 EVALUATE

The answer is written correctly with one significant figure to match the number of significant figures in the given 20 mol CO₂, and the units cancel to leave mol LiOH, which is the unknown. The equation shows that twice the amount in moles of LiOH reacts with CO₂. Therefore, the answer should be 2 \times 20 = 40.