SAMPLE PROBLEM H

Propane, C_3H_8, is a gas that is sometimes used as a fuel for cooking and heating. The complete combustion of propane occurs according to the following balanced equation.

$$C_3H_8(g) + 5O_2(g) \longrightarrow 3CO_2(g) + 4H_2O(g)$$

(a) What will be the volume, in liters, of oxygen required for the complete combustion of 0.350 L of propane? (b) What will be the volume of carbon dioxide produced in the reaction? Assume that all volume measurements are made at the same temperature and pressure.

SOLUTION

1 ANALYZE

Given: balanced chemical equation
V of propane = 0.350 L

Unknown: **a.** V of O_2 in L
b. V of CO_2 in L

2 PLAN

a. V of $C_3H_8 \longrightarrow V$ of O_2

b. V of $C_3H_8 \longrightarrow V$ of CO_2

All volumes are to be compared at the same temperature and pressure. Therefore, volume ratios can be used like mole ratios to find the unknowns.

3 COMPUTE

a. $0.350 \text{ L } C_3H_8 \times \dfrac{5 \text{ L } O_2}{1 \text{ L } C_3H_8} = 1.75 \text{ L } O_2$

b. $0.350 \text{ L } C_3H_8 \times \dfrac{3 \text{ L } CO_2}{1 \text{ L } C_3H_8} = 1.05 \text{ L } CO_2$

4 EVALUATE

Each result is correctly given to three significant figures. The answers are reasonably close to estimated values of 2, calculated as 0.4×5, and 1.2, calculated as 0.4×3, respectively.

PRACTICE

Answers in Appendix E

1. Assuming all volume measurements are made at the same temperature and pressure, what volume of hydrogen gas is needed to react completely with 4.55 L of oxygen gas to produce water vapor?
2. What volume of oxygen gas is needed to react completely with 0.626 L of carbon monoxide gas, CO, to form gaseous carbon dioxide? Assume all volume measurements are made at the same temperature and pressure.
3. Nitric acid can be produced by the reaction of gaseous nitrogen dioxide with water, according to the following balanced chemical equation.

$$3NO_2(g) + H_2O(l) \longrightarrow 2HNO_3(l) + NO(g)$$

If 708 L of NO_2 gas react with water, what volume of NO gas will be produced? Assume the gases are measured under the same conditions before and after the reaction.

extension
Go to **go.hrw.com** for more practice problems that ask you to use mole ratios in stoichiometry.
Keyword: HC6GASX