2.1 • Chemical Bonding

GAS STOICHIOMETRY

1. Assuming no change in temperature and pressure, calculate the volume of O\textsubscript{2} (in liters) required for the complete combustion of 14.9 L of butane (C\textsubscript{4}H\textsubscript{10}).

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2 \text{C}_4\text{H}_{10}(g) + 13 \text{O}_2(g) \rightarrow 8 \text{CO}_2(g) + 10 \text{H}_2\text{O}(l)
\]

2. The equation for the metabolic breakdown of glucose is the same as the equation for the combustion of glucose in air: C\textsubscript{6}H\textsubscript{12}O\textsubscript{6}(s) + 6 O\textsubscript{2}(g) \rightarrow 6 \text{CO}_2(g) + 6 \text{H}_2\text{O}(l). Calculate the volume of CO\textsubscript{2} produced at 37°C and 1.00 atm when 5.60 g of glucose is used up in the reaction.

3. A 2.24 L sample of hydrogen chloride gas at 2.61 atm and 28°C is completely dissolved in 668 mL of water to form hydrochloric acid solution. Calculate the molarity of the acid solution. Assume no change in volume.

4. Methane, the principal component of natural gas, is used for heating and cooking. The combustion process is CH\textsubscript{4}(g) + 2 O\textsubscript{2}(g) \rightarrow \text{CO}_2(g) + 2 \text{H}_2\text{O}(l). If 15.0 moles of CH\textsubscript{4} are reacted, what is the volume of CO\textsubscript{2} (in liters) produced at 23.0°C and 0.985 atm?

5. In alcohol fermentation, yeast converts glucose to ethanol and carbon dioxide: C\textsubscript{6}H\textsubscript{12}O\textsubscript{6}(s) \rightarrow 2 \text{C}_2\text{H}_5\text{OH}(l) + 2 \text{CO}_2(g). If 5.97 g of glucose are reacted and 1.44 L of CO\textsubscript{2} gas are collected at 293 K and 0.984 atm, what is the percent yield of the reaction?

6. Ethanol (C\textsubscript{2}H\textsubscript{5}OH) burns in air: C\textsubscript{2}H\textsubscript{5}OH(l) + O\textsubscript{2}(g) \rightarrow \text{CO}_2(g) + \text{H}_2\text{O}(l). Balance the equation and determine the volume of air in liters at 35.0°C and 790 mmHg required to burn 227 g of ethanol. Assume that air is 21.0% O\textsubscript{2} by volume.