Check Your Understanding

Checking Concepts

1. Identify each of the following chemical reactions as synthesis, decomposition, single replacement, double replacement, neutralization (acid-base), or combustion.
   (a) $HCl + KOH \rightarrow KCl + H_2O$
   (b) $S_8 + 12O_2 \rightarrow 8SO_3$
   (c) $(NH_4)_2CO_3 + Ca(NO_3)_2 \rightarrow 2NH_4NO_3 + CaCO_3$
   (d) $N_2 + 3Zn \rightarrow Zn_3N_2$
   (e) $C_4H_8 + 6O_2 \rightarrow 4CO_2 + 4H_2O$
   (f) $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$
   (g) $Zn + 2HCl \rightarrow ZnCl_2 + H_2$
   (h) $H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + 2H_2O$
   (i) $2HF \rightarrow H_2 + F_2$
   (j) $2Au(NO_3)_3 + 3Cu \rightarrow 2Au + 3Cu(NO_3)_2$

Understanding Key Ideas

2. Combustion and single replacement reactions both involve an element reacting with a compound. How can you tell the difference between these two reactions by looking only at the reactants?
3. No classification system is perfect. Find an example in this chapter of a chemical reaction that could be classified in more than one way.
4. Classify each of the following reactions, and write balanced formula equations for them.
   (a) sodium + oxygen → sodium oxide
   (b) sodium sulfate + calcium chloride → sodium chloride + calcium sulfate
   (c) propane (C_3H_8) + oxygen → carbon dioxide + water
   (d) sulfuric acid + potassium hydroxide → potassium sulfate + water
   (e) aluminum chloride → aluminum + chlorine
   (f) cadmium + gold(III) nitrate → cadmium nitrate + gold
   (g) strontium hydroxide + lead(II) bromide → strontium bromide + lead(II) hydroxide
   (h) glucose ($C_6H_{12}O_6$) + oxygen → carbon dioxide + water
   (i) nitrogen + oxygen → dinitrogen trioxide
   (j) nitric acid + zinc → zinc nitrate + hydrogen
5. Classify each reaction, and write the formula of each product or products. Balance the equation.
   (a) $Na + N_2 \rightarrow$
   (b) $AlF_3 \rightarrow$
   (c) $CuSO_4 + Al \rightarrow$
   (d) $CaI_2 + Pb(NO_3)_2 \rightarrow$
   (e) $C_4H_{10} + O_2 \rightarrow$
   (f) $AgNO_3 + NaBr \rightarrow$
   (g) $CsI + Cl_2 \rightarrow$
   (h) $HCl + NaOH \rightarrow$
   (i) $K_2Cr_2O_7 + AgNO_3 \rightarrow$
   (j) $C_5H_{10}O_5 + O_2 \rightarrow$
6. Write the balanced formula equation for the synthesis of iron(III) chloride (shown below) from its elements.

Pause and Reflect

When classifying a reaction, why might it *not* be helpful to consider whether the reaction produces water?