Name:_____Date:_____Block:____

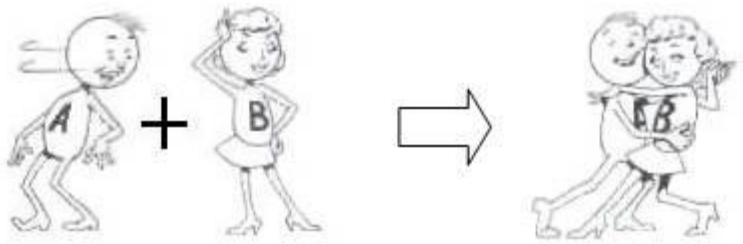
Types of Chemical Reactions

There are literally thousands of different chemical reactions. It would be impossible to memorize them all. However, most chemical reactions fit into five major categories. Understanding these categories of reactions can help you predict how compounds will react and what products will form.

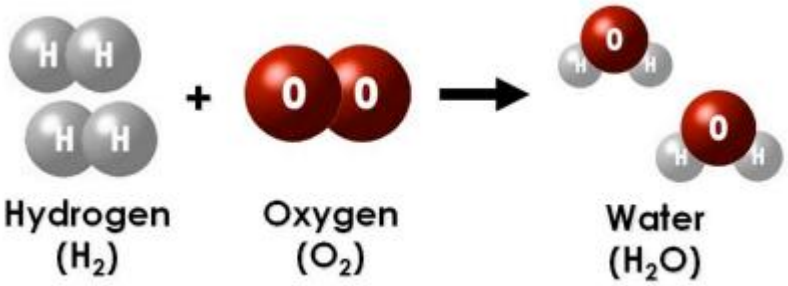
1. Synthesis

A synthesis reaction is a type of chemical reaction in which two or more different substances (elements or compounds) combine and form one compound. Synthesis means "putting together". You can recognize a synthesis reaction because two or more reactants form only one product. The general format of a synthesis reaction is shown below.

$$A + B \rightarrow AB$$



For example, hydrogen (H_2) reacts with oxygen (O_2) to form water (H_2O):



2. Decomposition

In a decomposition reaction, one compound breaks down into two or more simpler substances. Notice that decomposition is the reverse of synthesis. You can recognize a decomposition reaction because one reactant forms two or more products. The general format of a decomposition reaction is shown below.

$$AB \rightarrow A + B$$

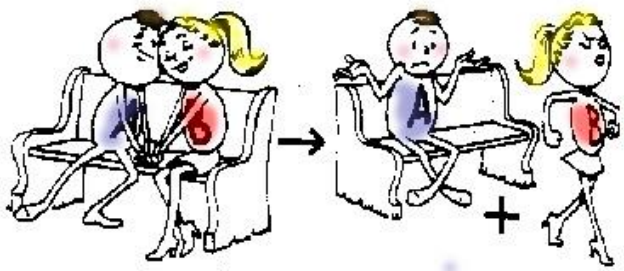
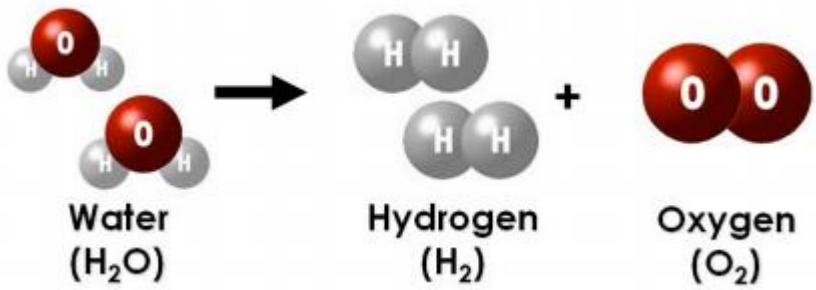


Fig. 3-4. Decomposition

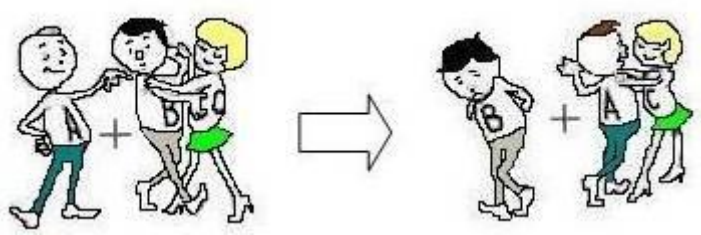
For example, water (H_2O) decomposes into hydrogen (H_2) and oxygen (O_2) when exposed to electricity:



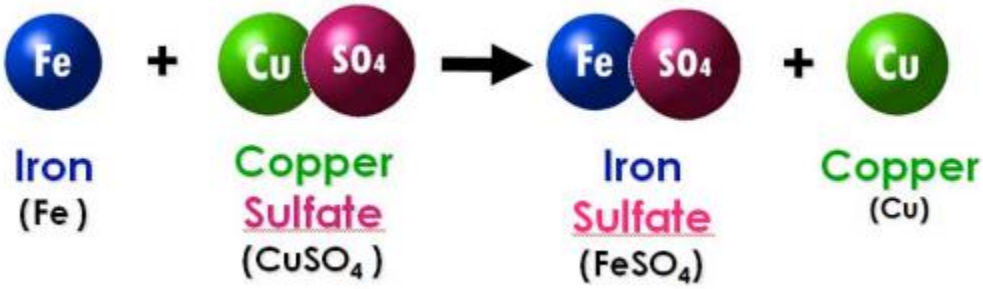
3. <u>Single Replacement</u>

In a single replacement (also called single displacement), one element replaces another element in a compound. In this type of reaction, an element and a compound react to form a different element and a different compound. The general format of a decomposition reaction is shown below.

A + BC → AC + B



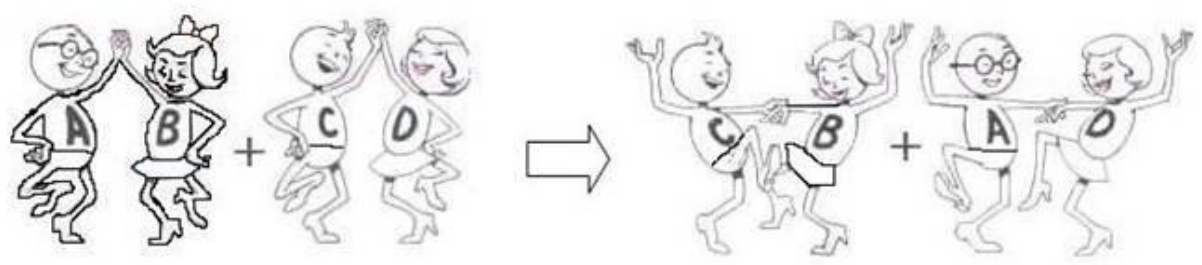
For example, the reaction between iron (Fe) and copper sulfate ($CuSO_4$) is an example of a single replacement reaction:



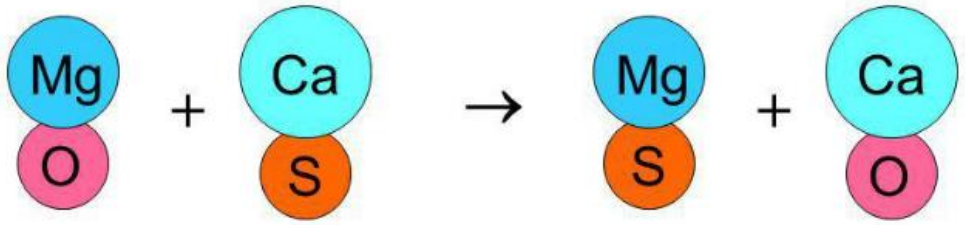
4. Double Replacement

In a double replacement (also called double displacement), the positive ions in two compounds switch places, forming two new compounds. In this type of reaction, two compounds react and form two new compounds. The general format of a double replacement reaction is shown below.

$$AB + CD \rightarrow CB + AD$$



For example, the reaction between magnesium oxide (MgO) and calcium sulfide (CaS) is an example of a double replacement reaction:

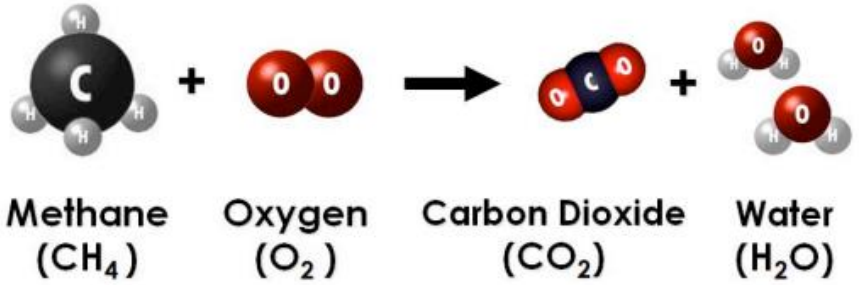


5. Combustion

Combustion is a chemical reaction in which a substance reacts with oxygen and releases energy. This energy usually is released as thermal energy and light energy. For example, burning is a common combustion reaction. The general format of a combustion reaction of a hydrocarbon (compound made of hydrogen and carbon) is shown below. The products of the combustion of a hydrocarbon are always CO_2 and H_2O.

$$C_xH_y + O_2 \rightarrow CO_2 + H_2O$$

For example, the burning of fossil fuels, like methane (CH_4) produces carbon dioxide (CO_2) and water vapor (H_2O):



Summary Questions

1. Read the descriptions below. Then write the type of reaction that matches each description.

a. _____ A reaction in which one element replaces another in a compound.

b. _____ A reaction in which two or more substances combine to form a new compound.

c. _____ A reaction in which a substance reacts with oxygen to produce thermal and light energy

d. _____ A reaction in which the positive ion on one compound replaces the positive ion of another compound.

e. _____ A reaction in which one substance breaks down into two more substances.

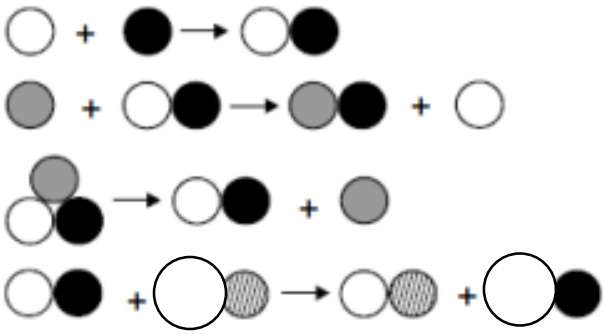
2. Examine the diagrams below. Then identify the type of reaction that each set of symbols represent.

a. _____

b. _____

c. _____

d. _____



3. Classify each chemical reaction by writing the reaction type in the blank to the left. Then, balance the equation.

a. _____ ___ Al + ___ O_2 → ___ Al_2O_3

b. _____ ___ HgO → ___ Hg + ___ O_2

c. _____ ___ NaOH + ___ H_2SO_4 → ___ Na_2SO_4 + ___ H_2O

d. _____ ___ Fe + ___ O_2 → ___ Fe_2O_3

e. _____ ___ $Pb(NO_3)_2$ + ___ $K_2(CrO_4)$ → ___ $PbCrO_4$ + ___ KNO_3

f. _____ ___ H_2 + ___ N_2 → ___ NH_3

g. _____ ___ Fe + ___ $CuCl_2$ → ___ $FeCl_2$ + ___ Cu

h. _____ ___ $KClO_3$ → ___ KCl + ___ O_2

i. _____ ___ Mg + ___ HCl → ___ H_2 + ___ $MgCl_2$