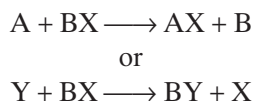


## Single-Displacement Reactions

In a **single-displacement reaction**, also known as a *replacement reaction*, one element replaces a similar element in a compound. Many single-displacement reactions take place in aqueous solution. The amount of energy involved in this type of reaction is usually smaller than the amount involved in synthesis or decomposition reactions. Single-displacement reactions can be represented by the following general equations.



A, B, X, and Y are elements. AX, BX, and BY are compounds.

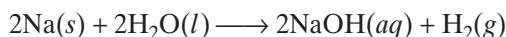
### Displacement of a Metal in a Compound by Another Metal

Aluminum is more active than lead. When solid aluminum is placed in aqueous lead(II) nitrate,  $\text{Pb}(\text{NO}_3)_2(aq)$ , the aluminum replaces the lead. Solid lead and aqueous aluminum nitrate are formed.

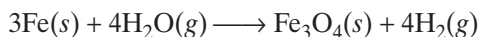


### Displacement of Hydrogen in Water by a Metal

The most-active metals, such as those in Group 1, react vigorously with water to produce metal hydroxides and hydrogen. For example, sodium reacts with water to form sodium hydroxide and hydrogen gas.

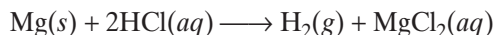


Less-active metals, such as iron, react with steam to form a metal oxide and hydrogen gas.



### Displacement of Hydrogen in an Acid by a Metal

The more-active metals react with certain acidic solutions, such as hydrochloric acid and dilute sulfuric acid, replacing the hydrogen in the acid. The reaction products are a metal compound (a salt) and hydrogen gas. For example, when solid magnesium reacts with hydrochloric acid, as shown in **Figure 11**, the reaction products are hydrogen gas and aqueous magnesium chloride.



### Displacement of Halogens

In another type of single-displacement reaction, one halogen replaces another halogen in a compound. Fluorine is the most-active halogen. As



**FIGURE 11** In this single-displacement reaction, the hydrogen in hydrochloric acid,  $\text{HCl}$ , is replaced by magnesium,  $\text{Mg}$ .