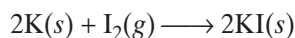
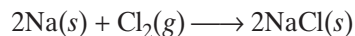
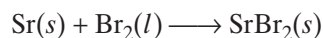
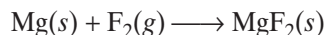


Reactions of Metals with Halogens

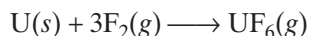
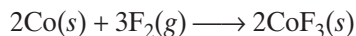
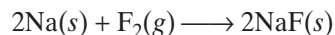
Most metals react with the Group 17 elements, the halogens, to form either ionic or covalent compounds. For example, Group 1 metals react with halogens to form ionic compounds with the formula MX , where M is the metal and X is the halogen. Examples of this type of synthesis reaction include the reactions of sodium with chlorine and potassium with iodine.



Group 2 metals react with the halogens to form ionic compounds with the formula MX_2 .



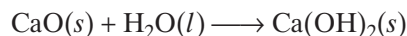
The halogens undergo synthesis reactions with many different metals. Fluorine in particular is so reactive that it combines with almost all metals. For example, fluorine reacts with sodium to produce sodium fluoride. Similarly, it reacts with cobalt to form cobalt(III) fluoride and with uranium to form uranium(VI) fluoride.



Sodium fluoride, NaF , is added to municipal water supplies in trace amounts to provide fluoride ions, which help to prevent tooth decay in the people who drink the water. Cobalt(III) fluoride, CoF_3 , is a strong fluorinating agent. And natural uranium is converted to uranium(VI) fluoride, UF_6 , as the first step in the production of uranium for use in nuclear power plants.

Synthesis Reactions with Oxides

Active metals are highly reactive metals. Oxides of active metals react with water to produce metal hydroxides. For example, calcium oxide reacts with water to form calcium hydroxide, an ingredient in some stomach antacids, as shown in **Figure 9**.



Calcium oxide, CaO , also known as lime or quicklime, is manufactured in large quantities. The addition of water to lime to produce $\text{Ca}(\text{OH})_2$, which is also known as slaked lime, is a crucial step in the setting of cement.

Many oxides of nonmetals in the upper right portion of the periodic table react with water to produce oxyacids. For example, sulfur dioxide, SO_2 , reacts with water to produce sulfurous acid.



FIGURE 9 Calcium hydroxide, a base, can be used to *neutralize* hydrochloric acid in your stomach. You will read more about acids, bases, and neutralization in Chapter 14.