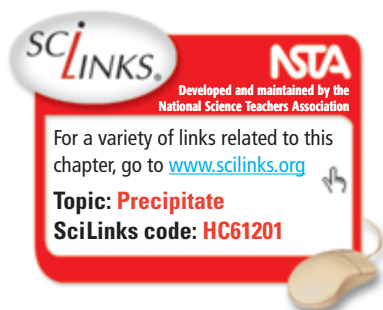
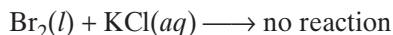


such, it can replace any of the other halogens in their compounds. Each halogen is less active than the one above it in the periodic table. Therefore, in Group 17 each element can replace any element below it, but not any element above it. For example, while chlorine can replace bromine in potassium bromide, it cannot replace fluorine in potassium fluoride. The reaction of chlorine with potassium bromide produces bromine and potassium chloride, whereas the combination of fluorine and sodium chloride produces sodium fluoride and solid chlorine.



Double-Displacement Reactions

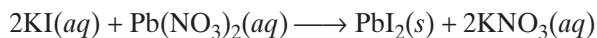
In double-displacement reactions, the ions of two compounds exchange places in an aqueous solution to form two new compounds. One of the compounds formed is usually a precipitate, an insoluble gas that bubbles out of the solution, or a molecular compound, usually water. The other compound is often soluble and remains dissolved in solution. A double-displacement reaction is represented by the following general equation.



A, X, B, and Y in the reactants represent ions. AY and BX represent ionic or molecular compounds.

Formation of a Precipitate

The formation of a precipitate occurs when the cations of one reactant combine with the anions of another reactant to form an insoluble or slightly soluble compound. For example, when an aqueous solution of potassium iodide is added to an aqueous solution of lead(II) nitrate, the yellow precipitate lead(II) iodide forms. This is shown in **Figure 12**.



The precipitate forms as a result of the very strong attractive forces between the Pb^{2+} cations and the I^- anions. The other product is the water-soluble salt potassium nitrate, KNO_3 . The potassium and nitrate ions do not take part in the reaction. They remain in solution as aqueous ions. The guidelines that help identify which ions form a precipitate and which ions remain in solution are developed in Chapter 13.

Formation of a Gas

In some double-displacement reactions, one of the products is an insoluble gas that bubbles out of the mixture. For example, iron(II) sulfide



FIGURE 12 The double-displacement reaction between aqueous lead(II) nitrate, $\text{Pb}(\text{NO}_3)_2(aq)$, and aqueous potassium iodide, $\text{KI}(aq)$, yields the precipitate lead(II) iodide, $\text{PbI}_2(s)$.