

Activity Series of the Elements

SECTION 3

OBJECTIVES

- Explain the significance of an activity series.
- Use an activity series to predict whether a given reaction will occur and what the products will be.

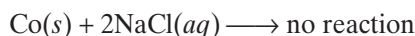
The ability of an element to react is referred to as the element's *activity*. The more readily an element reacts with other substances, the greater its activity is. An **activity series** is a list of elements organized according to the ease with which the elements undergo certain chemical reactions. For metals, greater activity means a greater ease of *loss* of electrons, to form positive ions. For nonmetals, greater activity means a greater ease of *gain* of electrons, to form negative ions.

The order in which the elements are listed is usually determined by single-displacement reactions. The most-active element, placed at the top in the series, can replace each of the elements below it from a compound in a single-displacement reaction. An element farther down can replace any element below it but not any above it. For example, in the discussion of single-displacement reactions in Section 2, it was noted that each halogen will react to replace any halogen listed below it in the periodic table. Therefore, an activity series for the Group 17 elements lists them in the same order, from top to bottom, as they appear in the periodic table. This is shown in **Table 3** on the next page.

As mentioned in Section 1, the fact that a chemical equation can be written does not necessarily mean that the reaction it represents will actually take place. Activity series are used to help predict whether certain chemical reactions will occur. For example, according to the activity series for metals in **Table 3**, aluminum replaces zinc. Therefore, we could predict that the following reaction does occur.



Cobalt, however, cannot replace sodium. Therefore, we write the following.



It is important to remember that like many other aids used to predict the products of chemical reactions, activity series are based on experiment. The information that they contain is used as a general guide for predicting reaction outcomes. For example, the activity series reflects the fact that some metals (potassium, for example) react vigorously with water and acids, replacing hydrogen to form new compounds. Other metals, such as iron or zinc, replace hydrogen in acids such as hydrochloric acid but react with water only when the water is hot

