Electrolytic Cells

SECTION 3

OBJECTIVES

- Describe the nature of electrolytic cells.
- Describe the process of electrolysis in the decomposition of water and in production of metals.
- Explain the process of electroplating.
- Describe the chemistry of a rechargeable cell.

Some oxidation-reduction reactions do not occur spontaneously but can be driven by electrical energy. *If electrical energy is required to produce a redox reaction and bring about a chemical change in an electrochemical cell, it is an* **electrolytic cell.** Most commercial uses of redox reactions make use of electrolytic cells.

How Electrolytic Cells Work

A comparison of electrolytic and voltaic cells can be seen in **Figure 13.** The voltaic cell shown in **Figure 13** has a copper cathode and a zinc anode. If a battery is connected so that the positive terminal contacts the copper electrode and the negative terminal contacts the zinc electrode, the electrons move in the opposite direction. The battery forces the cell to reverse its reaction; the zinc electrode becomes the cathode, and the copper electrode becomes the anode. The half-reaction at the anode, in which copper metal is oxidized, can be written as follows:

$$\overset{0}{\mathrm{Cu}} \longrightarrow \overset{+2}{\mathrm{Cu}^{2+}} + 2e^-$$

The reduction half-reaction of zinc at the cathode is written as follows:

$$\overset{+2}{\mathrm{Zn}^{2+}} + 2e^- \longrightarrow \overset{0}{\mathrm{Zn}}$$

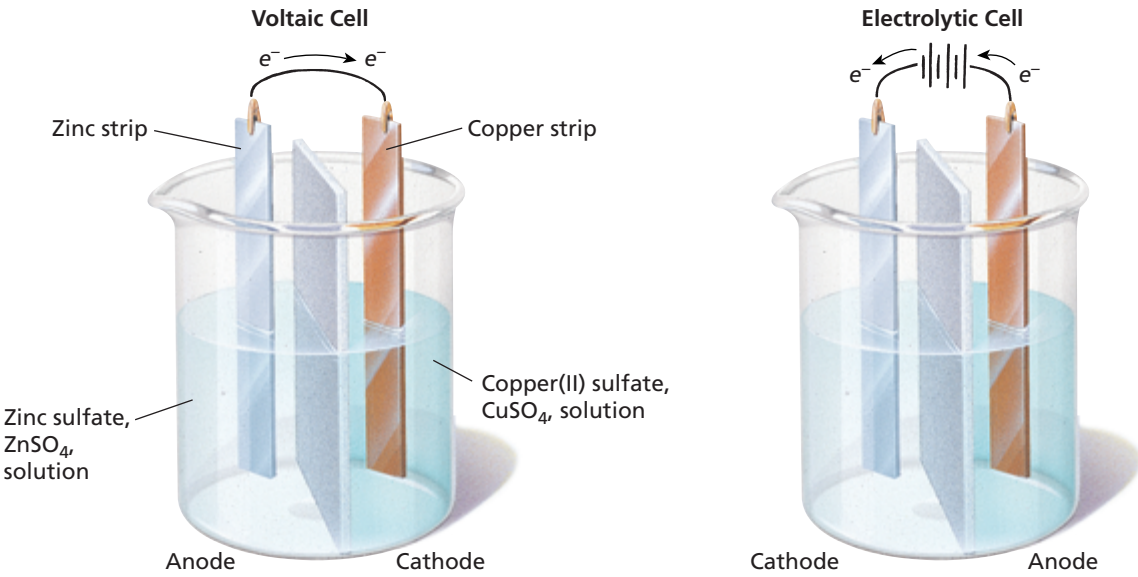

FIGURE 13 The direction in which the electrons move reverses if a voltaic cell is connected to a direct current source to become an electrolytic cell.