Metal sculptures exposed to the outside elements will usually corrode if not protected. The corrosion process is a series of redox reactions involving the metal of the sculpture. In some situations, the metals are deliberately left unprotected so that the surface will undergo changes that may enhance the esthetic value of the work.

# Electrochemical Reactions

Chemical reactions either absorb or release energy, which can be in the form of electricity. **Electrochemistry** is a branch of chemistry that deals with the interconversion of chemical energy and electrical energy. Electrochemistry has many common applications in everyday life. All sorts of batteries, from those used to power a flashlight to an automobile, rely on chemical reactions to generate electricity. Electricity is used to plate objects with decorative metals like gold or chromium. Electrochemistry is important in the transmission of nerve impulses in biological systems. Redox chemistry, the transfer of electrons, is behind all electrochemical processes.

The reaction of zinc metal with copper (II) ions is called a direct redox process or reaction. The electrons that are transferred in the reaction go directly from the \(\ce{Zn}\) atoms on the surface of the strip to the \(\ce{Cu^{2+}}\) ions in the area of the solution right next to the zinc strip. Electricity, on the other hand, requires the passage of electrons through a conducting medium, such as a wire, in order to do work. This work could be lighting a light bulb or powering a refrigerator or heating a house. When the redox reaction is direct, those electrons cannot be made to do work. Instead, we must separate the oxidation process from the reduction process and force the electrons to move from one place to another in between. That is the key to the structure of the electrochemical cell. An **electrochemical cell** is any device that converts chemical energy into electrical energy, or electrical energy into chemical energy.

There are three components that make up an electrochemical reaction. There must be a solution where redox reactions can occur. These reactions generally take place in water to facilitate electron and ion movement. A conductor must exist for electrons to be transferred. This conductor is usually some kind of wire so that electrons can move from one site to another. Ions also must be able to move through some form of salt bridge that facilitates ion migration.

## Summary

- Electrochemistry is a branch of chemistry that deals with the interconversion of chemical energy and electrical energy.
- An electrochemical cell is any device that converts chemical energy into electrical energy, or electrical energy into chemical energy.
- An electrochemical reaction requires:
  - A solution where redox reactions can occur.
  - A conductor for electron transfer.
  - A salt bridge for ions to move through.

## Contributors and Attributions

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