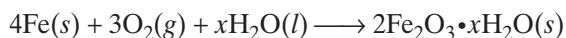


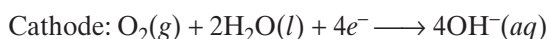
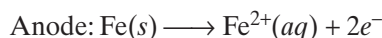
Corrosion and Its Prevention

Corrosion is an electrochemical process that has a large economic impact. Approximately 20% of all the iron and steel produced is used to repair or replace corroded structures. One of the metals most commonly affected by corrosion is iron. Rust, hydrated iron(III) oxide, forms by the following overall reaction.



The amount of hydration of the iron oxide, reflected by the coefficient x in the equation above, varies, and affects the color of the rust formed.

The mechanism for the corrosion of iron contains the following electrochemical reactions.



The anode and cathode reactions occur at different regions of the metal surface. The electric circuit is completed by electron flow through the metal itself, which acts like the wire in an electrochemical cell. The water on the surface of the metal serves as the salt bridge. Thus, for corrosion to occur, water and oxygen must be present with the iron.

As shown in **Figure 9**, when the iron is exposed to water and oxygen, the iron metal at the anodic site is oxidized to Fe^{2+} ions. The electrons released at this site travel along the metal (like the wire of a cell) to the cathodic region, where oxygen is reduced. The Fe^{2+} ions travel along the moisture toward the cathodic regions. At the cathode, the Fe^{2+} ions are further oxidized to Fe^{3+} ions and form rust, which is hydrated iron oxide, $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$.

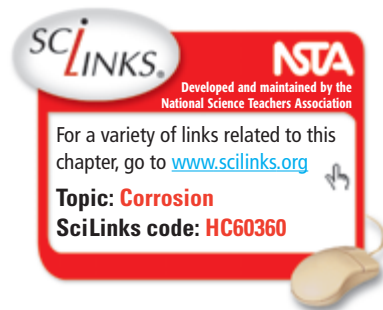
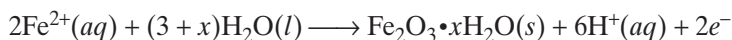


FIGURE 9 The cathodic reaction happens where the O_2 concentration is high. The anodic reaction happens in a region where the O_2 concentration is low, such as a pit in the metal.

