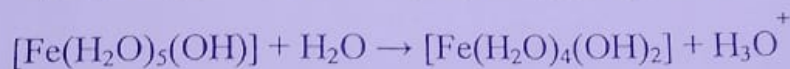
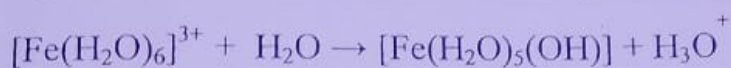


## The Chemistry of Iron

The two most stable oxidation states of iron are the +2 (ferrous) and +3 (ferric). One of the most commonly encountered ferrous salts is ferrous sulfate hexahydrate. The solid salt is pale-green in color and dissolves in water to give pale green solutions. However, the ferrous ion is readily oxidized to the ferric ion by atmospheric oxygen, and solutions slowly turn yellow due to this oxidation. The ferrous ion has an affinity for amine ligands. Addition of 1,10-phenanthroline and 2,2-bipyridine results in the formation of the complex ions  $[\text{Fe}(\text{bipy})_3]^{2+}$  and  $[\text{Fe}(\text{phen})_3]^{2+}$ . This serves as a test for the presence of the ferrous ion. The ferrous ion is extremely important in biological systems and is found in hemoglobin. Salts containing the  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$  ion are colorless or pale violet in color. However, in aqueous solution the ferric ion quickly hydrolyzes in water to give yellow-brown color more usually associated with iron.



As a result, such solutions are quite acidic. Strongly acidic solutions are necessary to prevent this hydrolysis. The ferric ion does not have the same affinity for amine ligands as the ferrous ion, but complexes with chelate ligands are formed. The ferric ion forms a well-known blood-red complex ion  $[\text{Fe}(\text{H}_2\text{O})_5(\text{SCN})]^{2+}$  when  $\text{SCN}^-$  is added. The color change is quite striking, even in dilute solutions, and serves as a chemical test for ferric ion. Two interesting complex ions are the ferrocyanide ion,  $[\text{Fe}(\text{CN})_6]^{4-}$  and the ferricyanide ion,  $[\text{Fe}(\text{CN})_6]^{3-}$ . The ferrocyanide ion is quite stable and is can be safely used in the laboratory. The ferricyanide, in contrast, is labile and therefore poisonous. Addition of a solution containing  $\text{Fe}^{3+}$  to a solution of  $[\text{Fe}(\text{CN})_6]^{4-}$  results in the formation of a compound known as Prussian blue, which has the formula  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ .