

## Iron Series

What is the name of the compound  $\text{Fe}(\text{NO}_3)_3$ ?

Place 30 drops of 0.1 M  $\text{Fe}(\text{NO}_3)_3$  in a clean, medium sized test-tube. What color is the aqueous solution of Fe(III)?

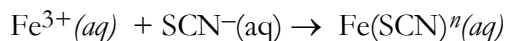
Add 5 drops of 2.0 M  $\text{Na}_2\text{CO}_3$  to your test-tube and record your observations.

Using your reactions with copper as a guide, propose two possible precipitates for the reaction of  $\text{Fe}(\text{NO}_3)_3$  and  $\text{Na}_2\text{CO}_3$ .

The actual precipitate in this case is iron(III) hydroxide. Write a balanced chemical equation that shows the formation of this precipitate.

Add eight drops of 3 M HCl to your test-tube and record your observations. Write a balanced equation for the reaction you observe.

As shown here, the thiocyanate ion,  $\text{SCN}^-$ , forms a metal-ligand complex with  $\text{Fe}^{3+}$



where  $n$  is the complex ion's charge. What is the value of  $n$ ?

Add 3 drops of 0.1 M KSCN to your test-tube and stir. What color is the iron(III) thiocyanate complex ion?

Iron (III) also forms a complex ion with the fluoride ion,  $\text{F}^-$ . Because the iron(III)–fluoride complex is more stable than the iron(III)–thiocyanate complex (you will learn why later this semester), the fluoride ion replaces the thiocyanate ion. Add 20 drops of 1.0 M NaF to your test-tube and stir. What color is the iron (III)–fluoride complex? (Note: you might see a little bit of the sodium salt of this complex precipitating out of solution, but most of it should stay in solution).

Write a balanced chemical equation for the reaction of the iron(III)–thiocyanate complex with the fluoride ion, assuming the iron(III)-fluoride complex has six fluoride ions for every  $\text{Fe}^{3+}$ .

Add 20 drops of 6.0 M  $\text{NH}_3$ . What do you observe? Write two balanced chemical equations for this reaction. Your first equation is an acid–base reaction that explains why a solution of ammonia contains hydroxide ion and your second chemical equation will show the reaction of  $\text{OH}^-$  ions with the iron(III)–fluoride complex ion.

This completes the series of reactions for iron. Discard the contents of your test-tubes and clean up!