Different Colored Complexes with the Same Ligands

Procedure

To demonstrate that different metal ions (with the same ligands) exhibit different colors in a coordination complex.

Materials

0.1 M solutions of copper nitrate and cobalt nitrate

Four 250 mL beakers

Concentrated aqueous ammonia

Procedure

- 1. Add 100 mL of the copper nitrate to two of the beakers, 100 mL of the cobalt nitrate to the other two.
- 2. Add the concentrated ammonia to one of the beakers to one of the beakers with the copper nitrate and to one of the beakers with the cobalt nitrate. Note that although the ammonia solution is clear, the colors actually get more intense (light blue to deep blue, pink to green blue).

Additional Information

1. The reactions are:

$$Cu(H_2O)_4^{2+}_{(aq)} + 4 \text{ NH}_3 \leftrightarrow Cu(NH_3)_4^{2+}_{(aq)} + 4 \text{ H}_2O_{(l)}$$
(pale blue)
$$Co(H_2O)_6^{2+}_{(aq)} + 6 \text{ NH}_3 \leftrightarrow Co(NH_3)_4^{2+}_{(aq)} + 6 \text{ H}_2O_{(l)}$$
(pink)
(deep red)

2. This demonstration can be used with a discussion of complex ion equilibria.

Additional Information

Waste should be collected in a properly labelled container with UI# 203459.

Reference

Summerlin, L., Borgford, C., & Ealy J. Chemical Demonstrations: A Sourcebook for Teachers, Volume 2, Second Edition, 1988.