Chemistry 101 Laboratory
Fall 2005 - 2006

Lecture 10

Identifying the Mystery Metal

Purpose

- To conduct some tests, that are accompanied by a visual change, on few common metal ions.

- To identify unknown metal ions.

Theoretical Background

Metal ions can be easily identified; most metal ions undergo characteristic reactions with certain solutions. Such reactions include production of a gas, color change, or formation of a precipitate (visual change).

Experiment Overview

- conduct some tests with few common metal ions to see what colored precipitates they form with three solutions.
- make a chart of these reactions for easy reference.
- identify a "mystery" metal ion by treating it and comparing the results with the chart.

Experiment

- ***Metal ions used:*** **Al^{3+}, Cu^{2+}, Fe^{2+}, Fe^{3+}, Pb^{2+} and Ag^{+}.**

  Use available solutions of soluble compounds that contain the above ions.

- ***Reagents needed:***

  Ammonium sulfide, $(NH_4)_2S$

  Ammonium carbonate, $(NH_4)_2CO_3$

  Potassium iodide, KI

- Test each of the metal ions with each of the three reagents and record your observations. Write the corresponding chemical reactions.

Use a spot plate and run the reactions according to the following chart

	Ammonium Sulfide $(S)^{-2}$	Ammonium carbonate $(CO_3)^{-2}$	Potassium Iodide (I^-)
Aluminum (Al^{3+})			
Copper (II) (Cu^{2+})	CuS		
Iron (II) (Fe^{2+})		$Fe(OH)_2$	
Iron (III) (Fe^{+3})			
Lead (Pb^{2+})			PbI_2
Silver (Ag^+)			

Reactions Involved

a- Reactions with Ammonium Sulfide

* $2Al^{3+}(aq) + 3S^{2-}(aq) + 6H_2O_{(l)} \rightarrow 3H_2S(g) + 2Al(OH)_3(s)$ white

$Cu^{2+}(aq) + S^{2-}(aq) \rightarrow CuS(s)$ black

$Fe^{+2}(aq) + S^{-2}(aq) \rightarrow FeS(s)$ black

* $2Fe^{3+}(aq) + 3S^{2-}(aq) \rightarrow S(s) + 2FeS(s)$ black

$Pb^{2+}(aq) + S^{2-}(aq) \rightarrow PbS(s)$ black

$2Ag^{+}(aq) + S^{2-}(aq) \rightarrow Ag_2S(s)$ black

b- Reactions with Ammonium Carbonate

* $2Al^{3+}(aq) + 3CO_3^{2-}(aq) + 3H_2O_{(l)} \rightarrow 3CO_2(g) + 2Al(OH)_3(s)$
white

$Cu^{2+}(aq) + CO_3^{2-}(aq) \rightarrow CuCO_3(s)$
blue

* $Fe^{2+}(aq) + CO_3^{2-}(aq) + H_2O_{(l)} \rightarrow CO_{2(g)} + Fe(OH)_2(s)$
green

* $2Fe^{3+}(aq) + 3CO_3^{2-}(aq) + 3H_2O_{(l)} \rightarrow 3CO_{2(g)} + 2Fe(OH)_3(s)$
red

$Pb^{2+}(aq) + CO_3^{2-}(aq) \rightarrow PbCO_3(s)$
white

$2Ag+(aq) + CO_3^{2-}(aq) \rightarrow Ag_2CO_3(s)$
white

c- Reactions with Potassium Iodide

* $2Cu^{2+}(aq) + 4I^{-}(aq) \rightarrow 2CuI(s) + I_{2(s)}$
  light brown

$Pb^{2+}(aq) + 2I^{-}(aq) \rightarrow pbI_2(s)$
yellow

$Ag^{+}(aq) + I^{-}(aq) \rightarrow AgI_{(s)}$
yellow