

# Analysis of Group IV Cations

Thursday, March 08, 2007

1:46 PM

Purpose: To find which analytical group IV cations are present in an unknown sample.

Equations:

1. Analytical Group IV:  $\text{Cu}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ba}^{2+}$
2.  $\text{BaCO}_3(\text{s}) \rightarrow \text{Ba}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \quad K_{\text{sp}} = 2.0 \times 10^{-9}$
3.  $\text{SrCO}_3(\text{s}) \rightarrow \text{Sr}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \quad K_{\text{sp}} = 5.4 \times 10^{-10}$
4.  $\text{CaCO}_3(\text{s}) \rightarrow \text{Ca}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \quad K_{\text{sp}} = 3.3 \times 10^{-9}$
5.  $\text{BaCO}_3(\text{s}) + 2\text{CH}_3\text{CO}_2\text{H} \rightarrow \text{Ba}^{2+}(\text{aq}) + 2\text{CH}_2\text{CO}_2^- + \text{CO}_2(\text{g})$
6.  $\text{BaCrO}_4(\text{s}) \rightarrow \text{Ba}^{2+}(\text{aq}) + \text{CrO}_4^{2-} \quad K_{\text{sp}} = 2 \times 10^{-10}$
7.  $\text{SrCrO}_4(\text{s}) \rightarrow \text{Sr}^{2+}(\text{aq}) + \text{CrO}_4^{2-}(\text{aq}) \quad K_{\text{sp}} = 3.6 \times 10^{-5}$
8.  $\text{BaSO}_4(\text{s}) \rightarrow \text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq})$

Lab Partner: Allysen Valencia

Precautions:

1. Barium is toxic.
2. HCl is strong acid
3. No chemical disposal down the drain.

Procedure: From handout of "Analysis of Group IV Cations" by unknown author.

Data/Observations:

## A. Precipitation of Group IV Ions

Unkn wn	# 4-28	Descrip tion: White powder	Weight: .0565g
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It took 7 drops of HCL and heating with the bunsen burner to completely dissolve .0565g of unknown in 1mL of water.

Took 10 drops from dissolved solution and evaporated all liquid by heating under bunsen burner.

Added 12 drops water and 1 drop 12M HCL. Added 12 drops of ammonium hydroxide to make litmus paper turn blue (litmus paper was tested by observing that it turned blue in basic NaOH solution). A 13th drop was added as excess. At the 13th drop, a white precipitate formed at the top.

Placed in hot water bath for 3 minutes and cooled under room temperature water. Centrifuge was not needed and we used dropper to extract aqueous layer on top.

## B. Separation and Identification of Barium Ions

A yellow precipitate was observed which indicates presence of barium. Added 2 drops 0.12M HCL and did flame test. Observed slight green/yellow on control of pure barium. Our unknown solution was only orange in flame test.

## C. Separation and Identification of Strontium

Added 2 drops of ammonia hydroxide. Instructions indicated to add ammonia until orange turned yellow, but our initial solution was yellow. By adding the ammonia, our solution turned from a dark yellow to a lighter yellow.

No precipitate formed when adding ethyl alcohol.

## D. Identification of Calcium

No precipitate formed with adding .4M ammonium oxalate and the flame test was orange.

Conclusion:

Based on our experimental results, the unknown could only have contained Barium. The yellow precipitate observed in part B shows that our unknown could have contained barium, but our flame test for barium did not turn yellow. The flame test was pointed out to be inconclusive and a negative result does not necessarily mean that barium is not

present. The test for Strontium had no precipitate when adding ethyl alcohol and a negative flame test. By the time we got to part D, there was no precipitate left. We completed the steps anyways, but it was no surprise that we received negative results for calcium. Better results could have been obtained by having more precipitate from part A since the following steps relied on the precipitate from part A.