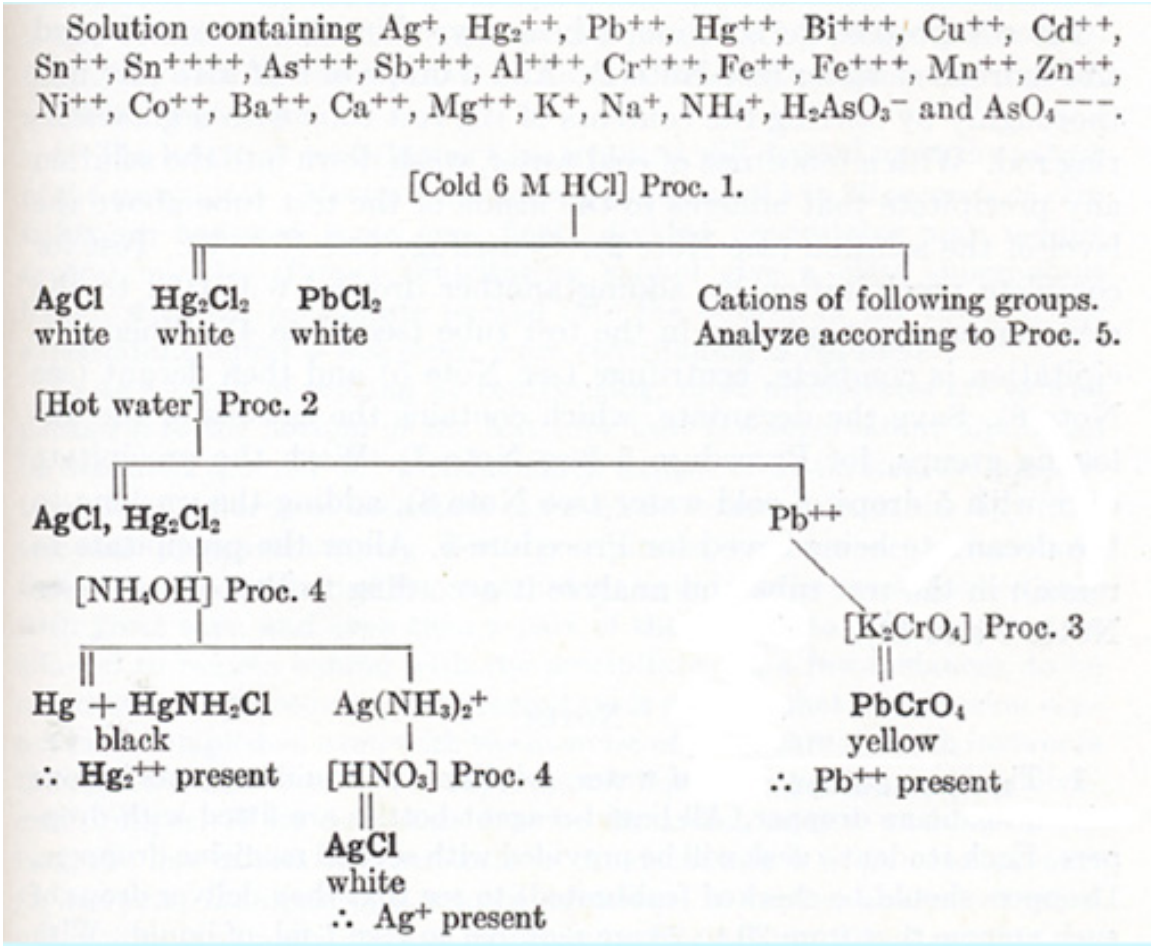
The Silver Group

The Separation of the Silver Group:

Facts:

The chlorides of Silver, Mercury(I), and Lead are insoluble in cold water and cold dilute Hydrochloric Acid; the chlorides of all other metals are soluble. This fact is the basis for the separation of Silver, Mercury(I), and Lead from all other metallic ions.
When HC1 or some other soluble chloride is added to a cold solution containing all the common cations, AgC1, Hg_2Cl_2, and $PbCl_2$ are precipitated. All other metals remain in solution as soluble chlorides The ions of Silver, Mercury(I), and Lead constitute the Silver group. Since HC1 is used to separate this group of ions from other cations by precipitating them as insoluble chlorides, it is called the *group reagent* for the Silver group.

Flow Outline: ..... The Silver Group



Procedure 1: Precipitation of the Silver Group.

Place 5 drops of the solution to be analyzed [(E-8 for the ***known***) **OR** (the ***issued sample*** for the ***unknown***)] [WARNING: **never** mix the *known* with the *unknown* !] in a 10 X 75 mm test tube and add 5 drops of water (always use distilled water in reactions and tap water for hot water bath). Add 2 drops of 6 M HC1 [A-2] and mix thoroughly stirring the contents of the test tube with a glass stirring rod. With a few drops of cold water, wash down into the solution any precipitate that adheres to the inside of the test tube above the level of the solution. Centrifuge and decant. [If this is a salt analysis, save the decantate, which contains the cations of the groups that follow, for Procedure 5] (Chuck it for now).

Wash the precipitate once with 5 drops of cold water . Allow the precipitate to remain in the test tube and analyze it according to Procedure 2.

The Separation of Lead from Silver and Mercury(I).

(Mercury I means mercurous, Hg^{+}).

Facts: The Silver-group precipitate is a mixture of $PbCl_2$, Hg_2C1_2, and AgCl. It is necessary to separate each individual member of the group in order that its presence may be confirmed. Lead is separated first. $PbCl_2$, is soluble in hot water; AgCl and Hg_2C1_2 are insoluble. This difference is the basis for the separation of Lead ions from Mercury(I) and Silver ions.

Procedure 2: Separation of Lead from Silver and Mercury(I).

Add 20 drops of hot water (distilled, as always) to the test tube containing the precipitate from Procedure 1, stir well until all of the precipitate is in suspension, then heat the tube by placing it in a 250-ml beaker of boiling tap water for about three minutes. Stir frequently. Centrifuge at once and decant into another test tube immediately after centrifuging; save the decantate, which contains Pb^{+2}, in the test tube, for Procedure 4.

Procedure 3: Detection of Lead.

Cool the decantate from Procedure 2. Add 1 drop of 0.2 M K_2Cr0_4 solution [D-1] ; a yellow precipitate ($PbCr0_4$) proves the presence of Lead. (WARNING: Do not confuse a colored solution, ions, with a precipitate, a solid).

Procedure 4: Separation and Detection of Silver and Mercury.

Facts: AgCl is soluble in NH_40H. Hg_2Cl_2 reacts with NH_4OH to form Hg and $HgNH_2CI$, both insoluble. This fact is the basis for the separation of Silver ions from Mercury(I) ions.

Procedure 4: Separation and detection of Mercury(I) and Silver.

Add 4 drops of 15 M NH_40H [A-8] to the precipitate from Procedure 2, mix thoroughly, centrifuge, and decant into another test tube, saving the decantate for testing for Silver. A black or very dark gray residue (Hg + $HgNH_2CI$) proves the presence of Mercury(I). To the decantate add l6 M HNO_3 [in the hood], drop by drop, with constant mixing with a stirring rod, until slightly acid (litmus test): A white precipitate (AgCl) proves the presence of Silver.

***WARNING* for all litmus tests:** *Be ye very careful that when testing the solution, that you have everything very well mixed in the tube. If you pull the stirring rod through the reagent on the sides of the tube, you may get a false reading.*

Here Endeth the Silver Group