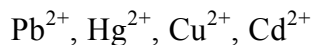
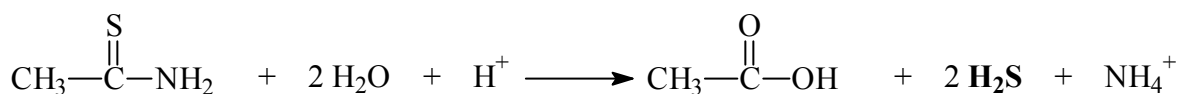


GROUP 2 CATIONS



1. Add 10 drops of 0.2 M solutions (0.1 M Pb^{2+}) of the four ions in four separate test tubes. Add 4 drops of 6 M HCl to each. Note: You already did this in Group 1 for Pb^{2+} , but you need to look for it in Group 2 as well. Think about **why** this is the case.
2. To any solutions remaining above (and the test tube containing the Pb^{2+} precipitate), add 10 drops 1 M thioacetamide.

Thioacetamide is a source of H_2S (sulfide ion in acidic medium) through the reaction:



When you write the chemical equations for what you observe, use H_2S as the reactant.

Heat the solution for 10 minutes in a water bath, add 10 drops water, 10 drops 1 M thioacetamide and 2 drops 1 M ammonium acetate, and heat for 10 more minutes. Prepare a wash solution of 5 mL H_2O , 2.5 mL 1 M ammonium acetate and 10 drops of 1 M thioacetamide. Wash any precipitates above with 2x 10 drops of this solution. This step is just **one** reaction. All of the parts are needed to ensure the formation of sufficient H_2S .

3. Add 20 drops of 3 M HNO_3 to any precipitate (#2), and heat for ~1 minute. Be sure to keep a close eye on the **amount** of precipitate present before **and** after adding the acid to determine whether it has dissolved at all. Save solutions for further tests (#5).
4. To any solutions formed (#3), add 6 drops concentrated H_2SO_4 .
5. To any insoluble precipitates (#3), add 12 drops concentrated HCl and 6 drops concentrated HNO_3 (this mixture is called **aqua regia**) and heat.
6. To any solutions formed (#5), cool and add 4 drops (or more) 0.2 M SnCl_2 solution.
7. To any solutions **remaining** (#4), add concentrated NH_3 slowly until strongly basic.
8. To any **solutions remaining** (#7), just acidify with 6 M acetic acid. Divide each solution into two parts.
 - a. Add a few drops of 0.2 M $\text{K}_4\text{Fe}(\text{CN})_6$ to one part of **each** solution.

- b. Add a small amount of solid $\text{Na}_2\text{S}_2\text{O}_4$ (sodium dithionite) to the other half of **each** solution. Sodium dithionite is relatively soluble in DW, but do not confuse undissolved sodium dithionite with the reaction (or lack of reaction) you are trying to observe.

Develop a procedure for separating and confirming the presence of the three ions (and Pb^{2+}) in a prepared mixture. Include in this procedure the procedure for the Group 1 cations for an overall scheme. Prepare a mixture of the four ions and test your Group 2 procedure, then include all the ions (Group 1 and 2) and test the overall procedure.

Unknown

When you are done with the known solutions **and** have developed a procedure to separate and identify ions in a mixture, you will be given a solution that contains 0 to all 6 ions. **Using your developed scheme** as a guide, test a **small portion** of the unknown mixture to determine which ions are present.