

Qualitative Analysis

Qualitative Inorganic Analysis is the process of determining which metal cations are present in a known or unknown solution.

Students work individually through this series of experiments.

Basic terms

Precipitate: A solid formed as a result of mixing reagents together in a solution.

Supernate: The liquid above the solid in a mixture of solid and solution.

Centrifuge: To spin very rapidly, thus compacting the solid at the bottom of a test tube. This allows the solid to be separated from the liquid by decanting.

Decant: To carefully pour the liquid (supernate) into a new test tube, leaving the solid behind in the original test tube.

Decantate: The liquid, which was poured off into the separate container.

Semi-Microscale Techniques

1. Mix solution with a glass stirring rod in a up-and-down circular pattern.
2. Centrifuge a test tube by placing it in a centrifuge sleeve, and placing another test tube in a sleeve directly opposite yours. Spin the sample for 1–2 minutes.
3. Decant a sample by first centrifuging it, then very carefully pour the liquid into a new test tube, leaving the solid behind in the original test tube.
4. Heat a test tube by placing it in a hot water bath. Use a test tube clamp to hold the test tube in the water bath.
5. Wash the precipitate by adding a small amount of the specified solution and mixing the solid with the solution using a stirring rod. Next centrifuge and decant the sample.
6. Test the pH of a solution by dipping a stirring rod into the solution and then touching a piece of litmus paper with the stirring rod.

SAMPLE DATA SHEET

Proced. Number	Reagent	Observations	Possible Formulas Solids Solns	Inferences
Initially	- - - -	light blue soln	Ag ⁺ , Pb ²⁺ Cu ²⁺ , Bi ³⁺	Group 1 & 2 Known
1-A1	6 M HCl	white ppt formed light blue soln	AgCl, PbCl ₂ Cu ²⁺ , Bi ³⁺	Ag ⁺ and/or Pb ²⁺ is present b/c a ppt formed w/ Cl ⁻
1-A2	6 M HCl	no add'l ppt formed		
1-B1	hot H ₂ O	some white ppt remained after heating	AgCl	Ag ⁺ indicated b/c AgCl unaffected by heat.
1-B2		colorless decantate	Pb ²⁺	
1-C1	CH ₃ COOH K ₂ CrO ₄	bright yellow ppt formed		Pb ²⁺ is present b/c a yellow ppt formed.

OBSERVATIONS

- In your OBSERVATIONS, always describe the precipitate AND decantate. Each will have its own chemical formula(s). Formulas are found in the Procedure Background or Flowchart.
- You do not have to write observations for steps that wash precipitates.

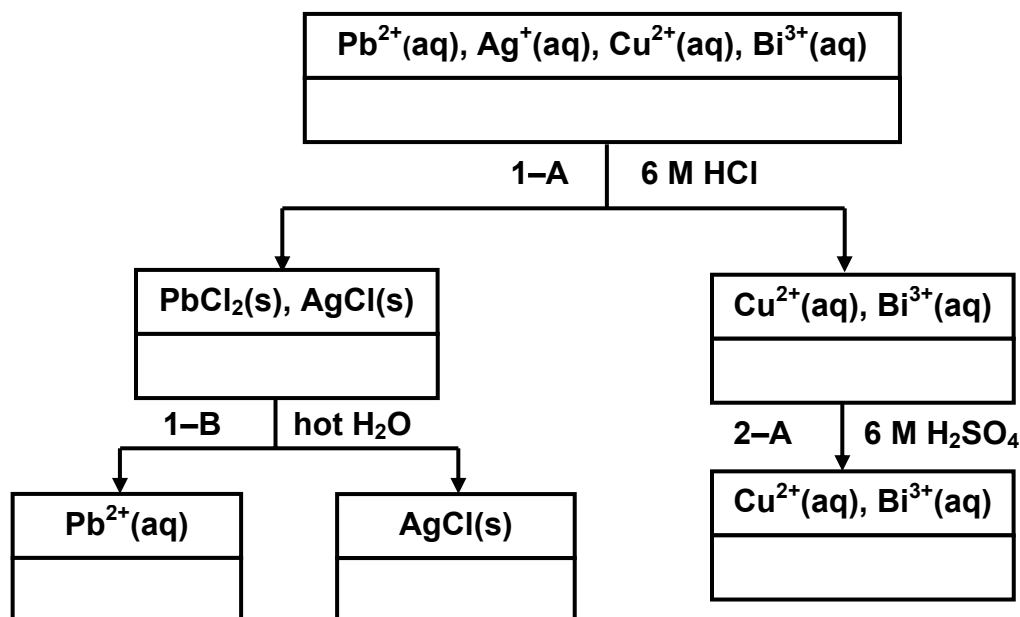
INFERENCE

- You must write an INFERENCE when forming solids, dissolving solids, separating solids from decantates, and for steps that indicate and/or confirm the presence or absence.
- You do not have to write an INFERENCE for each step.

FLOWCHARTS

- Copy the Known flowchart into your notebook. You will fill in the bottom half of each box with **your** observations. (For example, colorless solution or yellow solid)
- You can refer to the formulas in the top half of the boxes for filling in your data sheet. Note physical states are included (s, l, aq) with the formulas.
- The step number and reagent(s) are indicated on either side of the down arrow. The results of that step are found in the box at the end of the down arrow.
- When branching occurs in the flowchart to produce two boxes, it indicates a separation of decantate and solid. This occurs after centrifuging and decanting the sample. There will be one box for each test tube (one solid, the other decantate).

Sample Flowchart



Discussion

- The **INFERENCE** column of the data sheet **IS** the Discussion section of your lab report for the **KNOWN** solutions.
- For an **UNKNOWN** solution, the **RATIONALE IS** the Discussion section of your lab report. The Inference column is the "outline" for your rationale. The **Rationale** is a discussion of the logic used to determine the identity of the unknown.
- The **Rationale** must explain **step-wise** how the observations prove the presence (or absence) of a cation. It is **NOT** just the results of the confirmation step.