Experiment 38: Qualitative Analysis I

Pre-Lab Hints:

1. Review the six sections about the ions in the Introduction,
   including equations 38.2, 38.5, 38.6, 38.7, and 38.8.
2. A Brønsted acid is a proton (H^{+1}) donor, and a Brønsted base is a proton acceptor.
   Review equations 38.2, 38.5, 38.6, 38.7, and 38.8.
   Two of these reactions involve a proton transfer.
3. Refer to the figures and bullets accompanying part F (Centrifugation) of technique 11
   in the Laboratory Techniques section in the front of your lab manual.
4. a. Refer to step C2 and equation 38.2. The reagent converts ammonium ion into a gas.
   b. Refer to equation 38.3. The reagent converts the copper ion into a solid.
   c. Identical to 4b.
5. a. Refer to step C2 and equation 38.2. This is identical to 4a.
   b. There are two answers for b. Report both.
   Refer to equation 38.5 and step D3. Then, refer to equation 38.6 and step D4.
   c. Ca^{+2} is not truly confirmed by $K_2C_2O_4$ because Zn^{+2} precipitates as well.
   Refer to step E2 to describe how Ca^{+2} is actually confirmed.
6. Refer to the Constructing Flow Diagrams section in Dry Lab 4.
7. Review the attached Flow Diagram and the Constructing Flow Diagrams section.
   Before completing the chart, read the sections for each of the six ions
   in the experiment's Introduction and Procedure.

Procedure Notes

Each unknown will contain four of the six possible cations.
For each individual cation test, compare the unknown with a reference solution.
Also, use much less unknown solution than directed by the procedure,
because you will only have 5 ml total to work with!

Be patient, and use the best lab techniques possible.
Familiarize yourself with the techniques in dry lab 4.
Otherwise, your results can easily be erroneous.

For the flame tests in parts A, B and E, use a Bunsen burner.
For part C, heat the beaker on a hot plate.
For parts D (step 2), E (step 1), and F, warm the test tubes
with a water bath on a hot plate only.
Also for part D, use just enough zinc powder to completely precipitate the copper.
Add zinc slowly and stop adding when no more reaction is visible.

Before each of the flame tests (Na^+, K^+, and Ca^{+2}), clean the wire loop
extremely very thoroughly, and watch the flame very carefully.
K^+, in particular, has a faint color that does not last long.

For the report sheet columns, the test reagent is what you added to perform the test.
The evidence of reaction is a color of the solution or flame, a precipitate, or a change in pH.
The chemical responsible is the product of the reaction.
Also, just use *equation numbers from the introduction* for the reaction equations (except lines 1, 2, and 9), rather than writing the entire reactions.

Lab Questions

1. Na^{+1} ions are extremely common and their yellow flame color is very intense. Review the Sodium Ion section of the Introduction, as well as footnote 4 below it. Why is a positive flame test for sodium not an absolute confirmation that it is present?

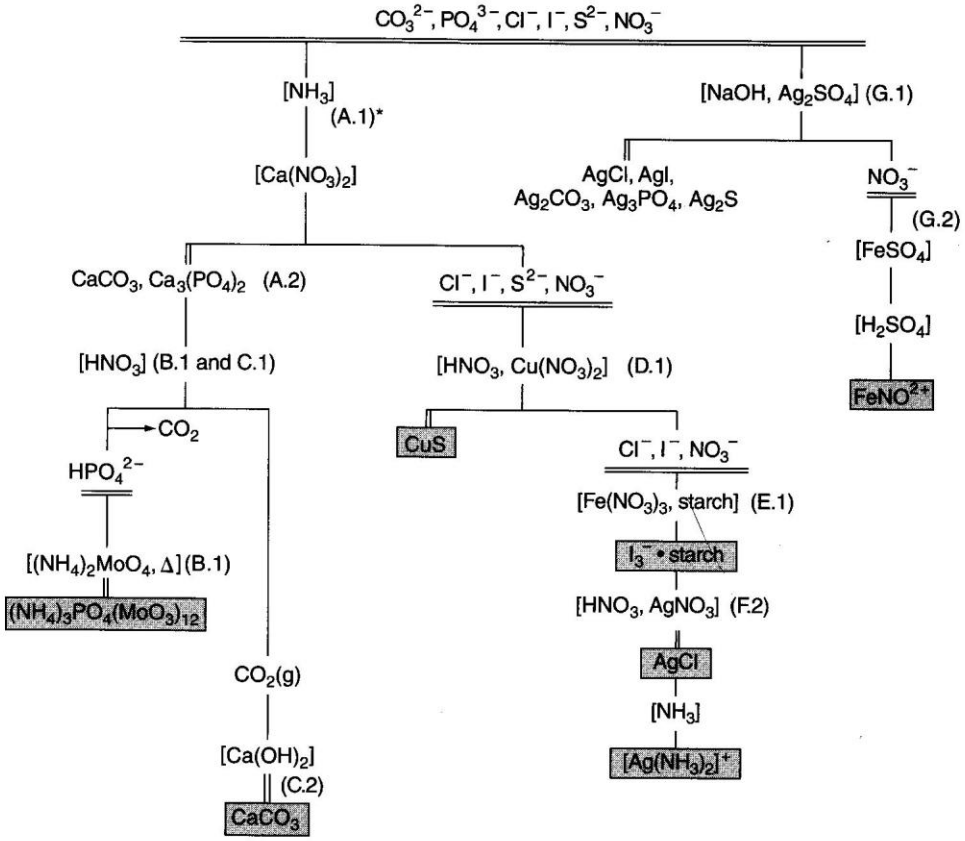
2. Review the first two paragraphs in the Procedure Overview, including the boldfaced, numbered items 1 and 2 about the reference solution and the test solution. Review part B of the Experimental Procedure, also. Explain why it is important to have a reference solution accompanying the test solution for the K^{+1} ion.

3. Review part C of the Experimental Procedure, as well as equation 38.2. Explain how the equilibrium concentrations will shift that reaction if HCl is added instead of NaOH. Describe the results that would be observed.

4. Review step E1 of the Experimental Procedure, as well as equation 38.7. Describe the ultimate fate of the Zn^{+2} ion after it dissolved into solution in step D1. Show the net ionic equation.

5. Review equation 38.5, as well as rule 3 for "Water-Insoluble Salts" in Appendix E (very back of lab manual). Describe what would be observed if NaOH is added instead of NH_3 in step D3. Show the net ionic equation.

Flow Diagram for Anion "Qual" Scheme



*Numbers in parentheses refer to parts of the Experimental Procedure