Experiment 39: Qualitative Analysis II

Pre-Lab Hints:

1. Review steps B2, C1, and E1 of the procedure.
2. Review equations 39.5. 39.6, 39.11, and 39.13.
3. a. Review "Separation of Ni^{+2} and Fe^{+3} from Zn^{+2} and Al^{+3}" section in the Introduction.
   b. Review "Iron (III) Ion" section in the Introduction.
   c. Review "Aluminum Ion" section in the Introduction.
4. Amphoteric means a substance can act as an acid or as a base.
   For instance, $Al(OH)_3$ can react with $3H^{+1}$ or with $3OH^{-1}$. Show both reactions.
   $Fe(OH)_3$ is not amphoteric, and can only act as a base. Show its reaction with $3H^{+1}$.
5. Use the description in part B of Dry Lab 4.
6. Refer to equations 39.1 through 39.13, as well as the indicated parts of the Procedure.
   Compare the reactants and products in the reaction equations with the flow diagram.

Procedure Notes

For each individual cation test, compare the unknown with the reference solution first.
If reference solution is not available, use $Fe(NO_3)_3$ as a reference for parts A and B, $Ni(NO_3)_2$ for part C, $Al(NO_3)_3$ for part D, and $Zn(NO_3)_2$ for part E.

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, as we learned in the dry lab.
Otherwise, your results can easily be erroneous.

Be sure to complete the precipitate in part A, or $Al(OH)_3$ will
remain precipitated with $Fe(OH)_3$ and $Ni(OH)_2$.

In part D, step 1, be very careful when decanting the solution, because the precipitate is difficult to see. Use a pipette to remove the upper layer if necessary.

Dispose of all solutions in the labeled waste jar.

For the report sheet columns, the test reagent is what you added to perform the test,
The evidence of reaction is either a complex ion or a precipitate, along with the color.
The chemical responsible is the product of the reactions.
That is, it is the substance that is formed and observed visually.
Except for lines 1 and 3, just use *equation numbers from the Introduction* for the reaction equations (39.1 through 39.13), rather than writing out each entire reaction.
For lines 1 and 3, refer to part A of the procedure as well as the "Separation of Ni^{+2} and Fe^{+3} from Zn^{+2} and Al^{+3}" section in the Introduction.

Lab Questions

1. Review equations 39.3, 39.4, 39.8 and 39.10. Describe what would be observed in part A1 if $NH_{3(aq)}$ was used instead of $NaOH_{(aq)}$. Note that two ions will form complex ions and that two ions will form precipitates. Include the formulas of all four products.

2. Review equation 39.3, as well as part B1 of the procedure. If no brown precipitate appears, which ion is not present? Would step B2 be necessary in this case? Explain.

3. Review equation 39.4, as well as part B1 of the procedure.
   If a blue complex ion appears, which ion may be present? Is this step a confirmation? Would step C1 be necessary in this case? Explain.

4. Review equation 39.11, as well as parts D1 and D2 of the procedure. Suppose a gel appears in part D1 which ambiguously appears like it may be a precipitate. What is the formula of this substance? Describe the test and the product that would confirm if this gel contains aluminum.

5. Review equations 39.12 and 39.13, as well as part E1 of the procedure. What affect does H^{+1} have on the zinc-ammonia complex ion? Which way would the equilibrium shift for these two reactions if H^{+1} was not present? What result would be observed in the test tube without H^{+1} present?