

11 Qualitative Analysis V: General Unknown

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- Apply the qualitative analysis scheme from Experiments 6, 7, 9, and 10 to the analysis of a solid unknown.

DISCUSSION

You have learned procedures for identifying eight cations and nine anions in aqueous solution. In this experiment you will apply those procedures to the analysis of solid ionic compounds. The unknowns may be single compounds consisting of one cation and one anion each, or they may be mixtures of compounds. Your instructor may give you more complete information about the nature of the unknowns and the number of cations and anions in each.

You can assume that your unknowns are water soluble. Some of them may be slow to dissolve, but after a few minutes enough will be in solution for you to proceed with the analysis. Use your knowledge of solubility rules to assist you in the analysis. For example, if your unknown contains Ba^{2+} , it will not contain SO_4^{2-} , CO_3^{2-} , SO_3^{2-} , or PO_4^{3-} , and you can skip the procedures of Experiment 9.

Because the formula weights of the unknowns may vary from less than 40 g/mol to more than 200 g/mol, it is not likely that your solutions will be the same concentration as the unknowns you have tested previously. Because of this, required volumes of reagents may not be the same as those suggested in previous procedures. Remember to add sufficient volumes of reagents to achieve complete separations to avoid later interferences. Do not make the common mistake of preparing solutions of the unknowns that are much too concentrated. Follow the recommended guidelines closely.

PROCEDURE

Obtain unknowns at the stockroom window, and immediately record the unknown numbers on the report. Inspect the solid closely to see if it appears to be uniform (probably a single compound) or composed of different types of crystals (probably a mixture of compounds). If it appears to be a mixture, be sure to take a large enough sample in each of the procedures below to include all parts of the mixture.

Prepare a solution of each unknown by dissolving 0.2-0.3 g of the solid in about 25 mL of distilled water. Swirl or stir to speed the solution process if necessary.

Cation tests

Test a 2 mL sample of the solution using the procedures of Experiment 6. Record your observations and conclusions on the report. You should check the solution with litmus paper for additional information. For example, if your unknown is acidic, you can conclude that Al^{3+} and/or NH_4^+ is present.

The Experiment 7 procedures will work best on very concentrated solutions of the unknowns. Add just a few drops of water to small samples of the solid unknowns to test for Na^+ , K^+ , and NH_4^+ .

Anion tests

Start with a 3 mL sample of the solution of the unknown, and refer to the procedures of Experiments 9 and 10. Modify the procedures as indicated below. If a step is not listed no modification is necessary.

Step 2. At first add only 1 drop of $\text{Ba}(\text{NO}_3)_2(\text{aq})$. If no precipitate forms, proceed to Step 6. If a precipitate does form, proceed as outlined in Step 2, saving the solution for Step 6 after precipitation is complete.

Step 6. Test the solution with litmus paper. If it is basic, add 1 M $\text{HNO}_3(\text{aq})$ dropwise until it is neutral to litmus. Save half of the solution for Step 8.

1] Qualitative Analysis V: General Unknown

Name _____
Section _____ Locker _____
Instructor _____

Analysis of the Unknowns

Complete the following table for your unknowns:

Unknown	Step	Observations	Conclusion

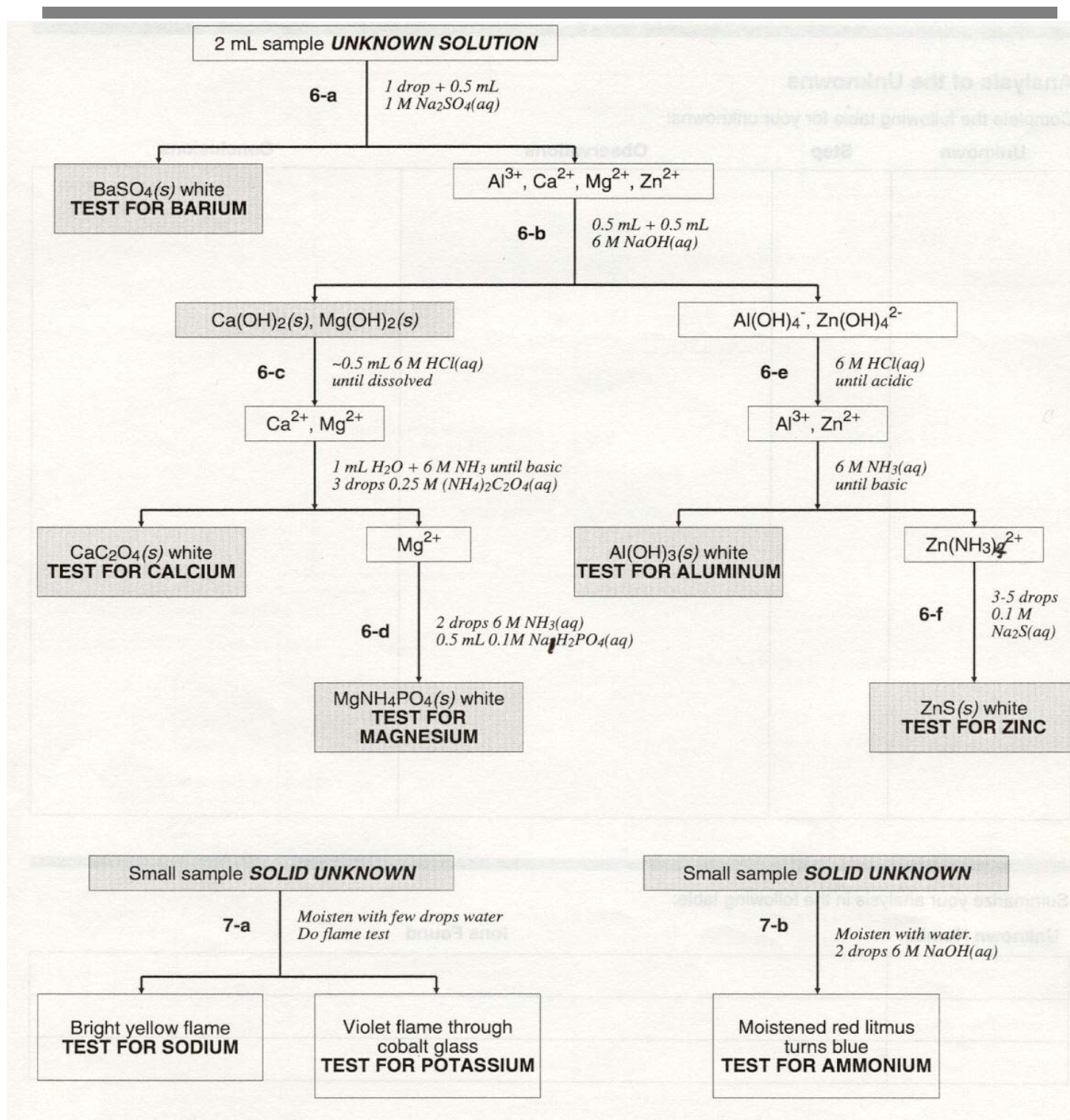
Summarize your analysis in the following table:

Unknown Number	Ions Found

SUMMARY FLOWCHART FOR THE CATIONS

Dissolve 0.2 to 0.3 grams of your SOLID UNKNOWN in water to obtain your UNKNOWN SOLUTION.

The possible cations are Al^{3+} , Ba^{2+} , Ca^{2+} , Mg^{2+} , Zn^{2+} , Na^+ , K^+ , and NH_4^+ . Use this page as a summary guide only; follow the detailed instructions in Experiments 6 and 7 as labeled in bold type. As before, precipitates are in shaded boxes; solutions in open boxes.



SUMMARY FLOWCHART FOR THE ANIONS

The possible anions are CO_3^{2-} , SO_4^{2-} , SO_3^{2-} , PO_4^{3-} , F^- , Cl^- , Br^- , and I^- . Use this page as a summary guide only; follow the detailed instructions in Experiments 9 and 10 as labeled in bold type.

