

12th WEEK

Introduction to Qualitative Analysis of Anions

The qualitative analysis of anions is not nearly so systematic as is that of cations. The anions often are divided into four main groups, but the anions are not separated into groups by precipitation only, as are the cations. Rather, the groupings provide a method of establishing which types of anions are present and which are absent. Thus, anion analysis begins by testing separate portions of the original sample, each for a specific group, with the group reagents. A positive reaction with a group reagent indicates the presence of one or more anions in that group. Specific tests for each anion in the group then are performed to reveal the presence or absence of that anion.

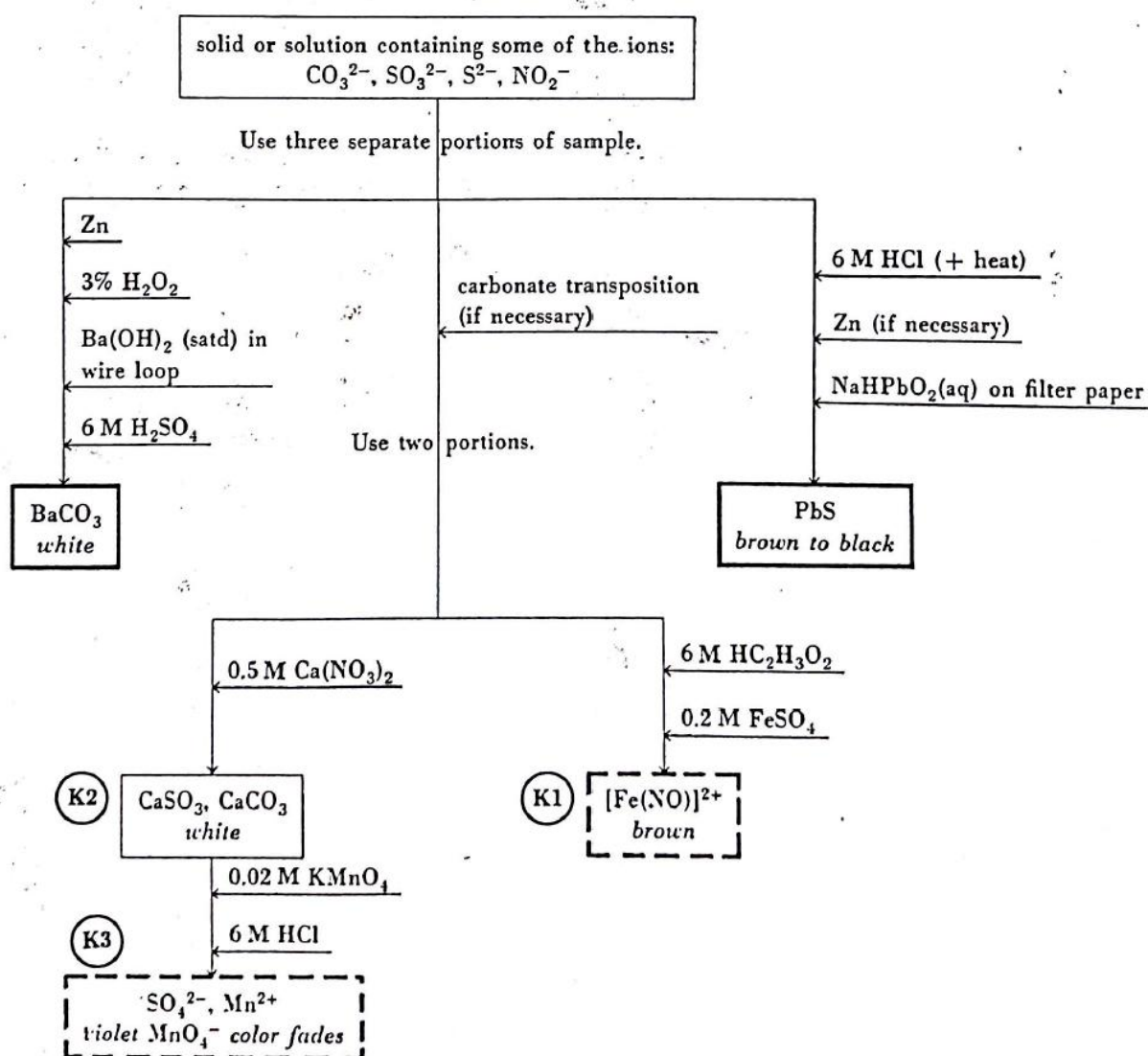
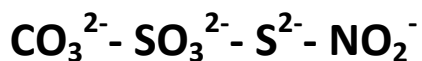
This procedure for anion analysis is in some ways easier and in other ways harder than the cation analysis scheme. The simplicity comes from using a fresh portion of sample for each test. Thus, there is little worry, either about using reagents that will interfere with subsequent tests or that previously used reagents will produce false results in a given analysis.

Detection of Anion Groups 1 and 2- Sample Analysis:

- Anion groups 1 and 2 UNKNOWN samples are given separately- Each student complete both of the procedures for their own UNKNOWN sample analysis.
- First, the presence of unknown anion group 1 members is tested by the addition of diluted sulfuric acid. Because the group is named as The Acid-Volatile group which relies on the gases produced after the addition of diluted sulfuric acid.
- Then, the presence of unknown anion group 2 members is tested by the precipitation reactions of anions with barium or calcium in ammoniacal solution.
- By taking separate portions from the original anion samples, the members of two anion groups are detected and confirmed.
- Two analysis schemes are given below.

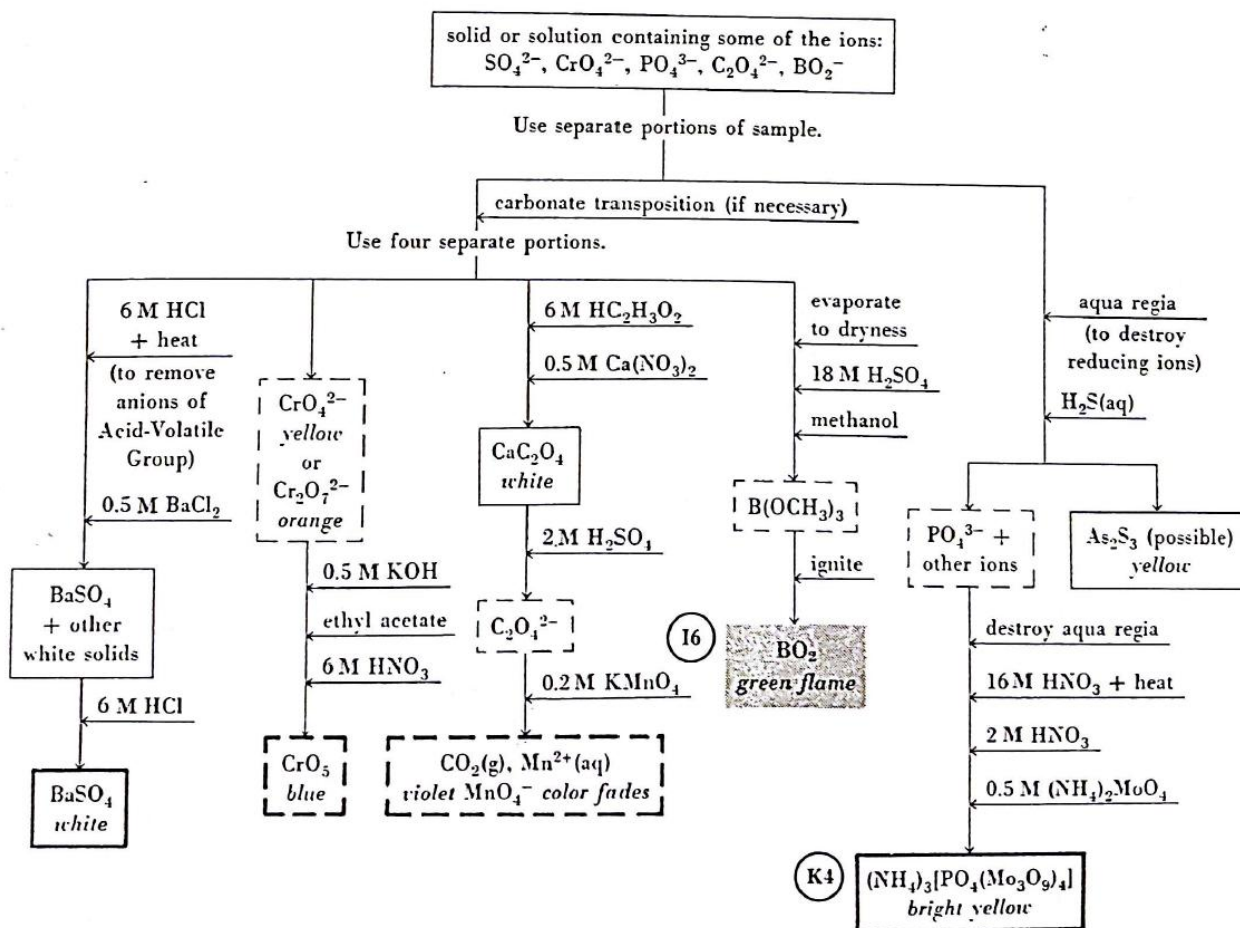
In all analysis schemes, precipitates are enclosed in boxes with solid lines, solutions are contained in boxes with dashed lines.

Anion Group 1: The Acid-Volatile Group-



Qualitative analysis flowchart for The Acid-Volatile Group

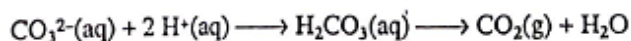
Anion Group 2: The Barium Group-



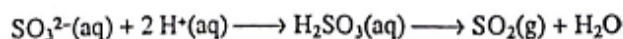
Qualitative analysis flowchart for The Barium Group

Some examples for the reactions of Anion Group 1

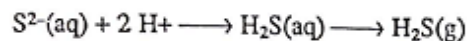
Carbonate ion yields colorless, odorless carbon dioxide gas.



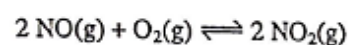
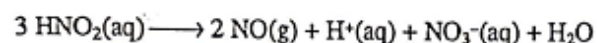
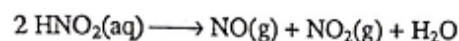
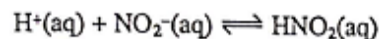
Sulfite ion yields colorless sulfur dioxide gas, which has a sharp, characteristic odor, that of a burning match.



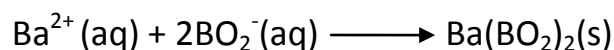
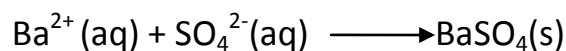
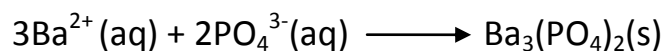
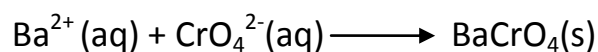
Sulfide ion produces hydrogen sulfide gas, which has a rotten egg odor and will blacken wet lead acetate paper.



And, finally, nitrite ion evolves brown nitrogen(IV) oxide gas, which has a sweet smell but is *poisonous*.



Some examples for the reactions of Anion Group 2



List of some reagents used in experiments are given below:

3% Hydrogen peroxide (H_2O_2)
0.2 M Iron(II)sulfate(FeSO_4)
6 M Acetic acid (CH_3COOH)
12 M Hydrochloride (HCl)
Saturated barium hydroxide (satd. $\text{Ba}(\text{OH})_2$)
0.02 M potassium permanganate (KMnO_4)
6 M Nitric acid (HNO_3)
18 M Sulfuric acid (H_2SO_4)
0.5 M Calcium nitrate ($\text{Ca}(\text{NO}_3)_2$)