

9th WEEK

Analysis of Cation Group 4 and Cation Group 5:

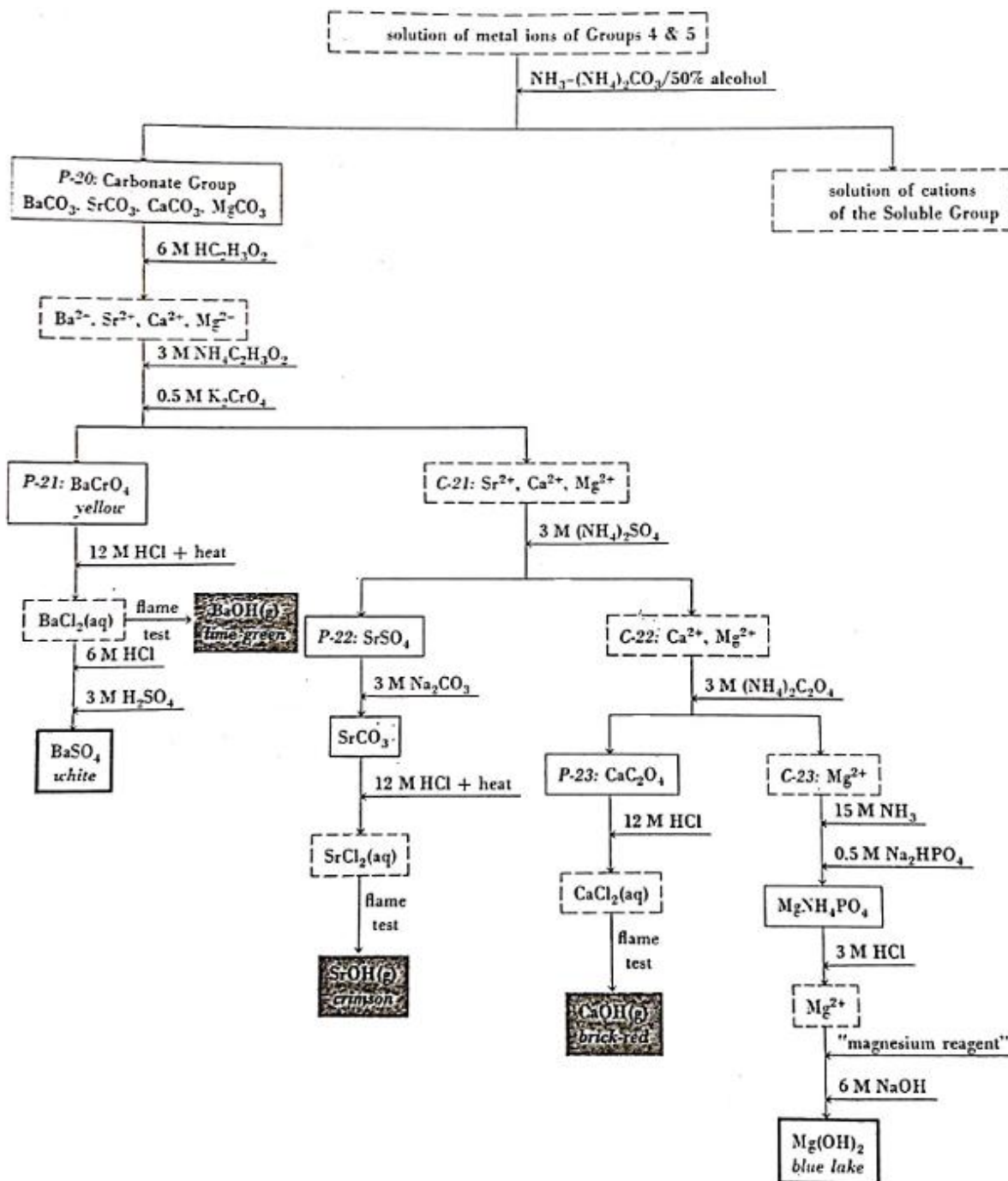
- Cation groups 4 and 5 UNKNOWN samples are given as a mixture- Each student complete both of the procedures for their own UNKNOWN sample analysis.
- First, the unknown cation group 4 sample is precipitated and the solution part is kept for the analysis of cation group 5 sample.
- Since the chemical and physical properties of the alkaline earth metals are quite similar, their separation relies on the differing solubilities of their salts. This makes the separation difficult. Therefore, **flame tests** are used to complement the chemical tests. The characteristic colors of the ions in the flame are in the boxes of flowcharts below.
- Two analysis schemes are given below.

Flame tests: The atoms or ions of the elements impart a characteristic color to a bunsen burner flame. The metal chlorides are more volatile than most other compounds, so the flame tests are performed with solutions of metal chlorides. The energy of the flame promotes an electron in the atom or ion being tested from a low energy level to a higher one. When the species leaves the flame, the excited electron returns to the lower energy level and the energy of the transition is emitted as light, with a characteristic wavelength of the ion tested.

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

Cation Group 4: The Carbonate Group- Ba^{2+} - Sr^{2+} - Ca^{2+} - Mg^{2+}

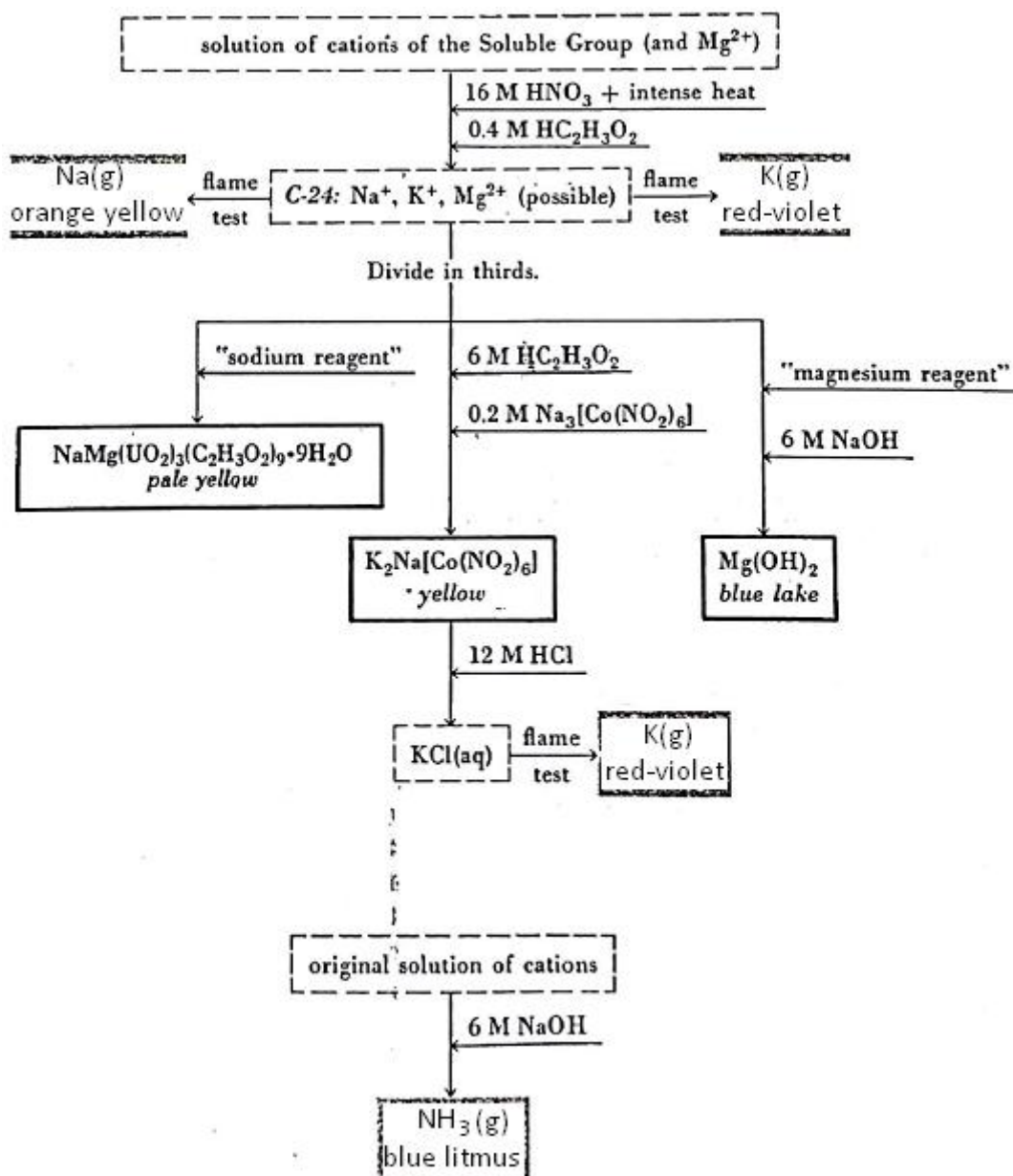
Barium(II), strontium(II), calcium(II), and magnesium(II) ions are called carbonate group due to their precipitation as carbonates by $(\text{NH}_4)_2\text{CO}_3$.



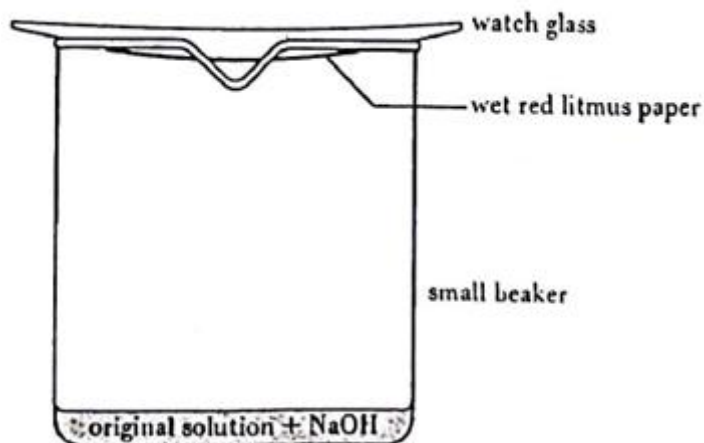
Qualitative analysis flowchart for The Carbonate Group

Cation Group 5: The Soluble Group- Na^+ - K^+ - NH_4^+

- The cations that are not precipitated as chlorides, sulfides, hydroxides or carbonates comprise the soluble group.
- Flame tests are used for Na^+ and K^+ . Since the physical and chemical properties of ammonium ion is similar to sodium and potassium ions, it can interfere the analysis of these ions. Therefore, a thermal decomposition of NH_4^+ step is performed before Na^+ and K^+ identification procedures.
- NH_4^+ is qualitatively analyzed in the original sample.

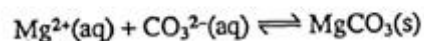
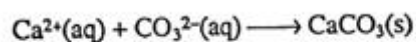
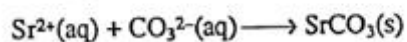
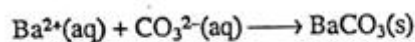


Qualitative analysis flowchart for The Soluble Group

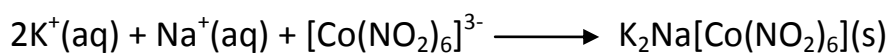
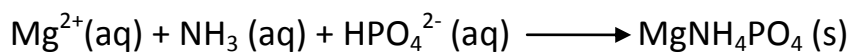
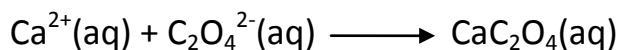
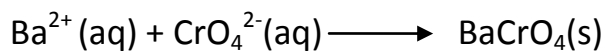


The separate test for ammonium ion

Some examples for precipitation reactions of Cation Group 4



Some examples for identification reactions for Cation Group 4 and 5



REPORT FOR QUALITATIVE ANALYSIS

Name- Surname:		Number:	
Sample No	4	Date	
Sample Name	Cation group 4+Cation Group 5		
Ions expected to be observed	To be filled by the assistant		
Analysis of ion under study	Procedure and Observation	Precipitation-Identification reactions for the ion	
Result			

List of some reagents used in experiments are given below:

Ammonia/ammonium carbonate buffer solution ($\text{NH}_3/\text{NH}_4\text{CO}_3$)
3 M Ammonium oxalate ($(\text{NH}_4)_2\text{C}_2\text{O}_4$)
6 M Ammonia solution (NH_3)
12 M Hydrochloride (HCl)
6 M Nitric acid solution (HNO_3)
4 M Potassium hydroxide (KOH)
3 M Ammonium sulfate ($(\text{NH}_4)_2\text{SO}_4$)
0.2 M Sodium hexanitrocobaltate(III) ($\text{Na}_3[\text{Co}(\text{NO}_2)_6]$)
Sodium carbonate (Na_2CO_3)