

## Appendix II: Solubility Rules

From Welcher & Hahn, "Semi-micro Qualitative Analysis"

- a) All nitrates are soluble, except the oxynitrates of antimony and bismuth,  $\text{SbONO}_3$  and  $\text{BiONO}_3$ .
- b) All acetates are soluble, although silver acetate may precipitate from a moderately concentrated solution. Ferric acetate and certain other acetates are hydrolyzed under certain conditions, and may precipitate as basic acetates, especially on warming.
- c) All chlorates are soluble.
- d) All chlorides, bromides and iodides are soluble except those of silver, lead and mercurous mercury. Lead chloride and lead bromide are slightly soluble in cold water, but are more soluble in hot water. Antimony and bismuth chlorides hydrolyze in water to form white precipitates of the oxychlorides,  $\text{SbOCl}$  and  $\text{BiOCl}$ .
- e) All sulfates are soluble except those of barium, strontium and lead. Calcium sulfate, silver sulfate and mercurous sulfate are slightly soluble in water, but calcium sulfate is rarely precipitated in reactions between the calcium and sulfate ions. Stannic sulfate hydrolyzes readily to form a white precipitate of the hydrate of stannic oxide.
- f) All salts of sodium, potassium and ammonium are soluble except such compounds as  $\text{NaSb}(\text{OH})_6$ ,  $\text{K}_2\text{NaCo}(\text{NO}_2)_6$ ,  $\text{K}_2\text{PtCl}_6$ ,  $(\text{NH}_4)_2\text{PtCl}_6$ ,  $\text{KClO}_4$ ,  $\text{K}_2\text{SiF}_6$ ,  $\text{KHC}_4\text{H}_4\text{O}_6$ ,  $\text{Na}_2\text{SiF}_6$ ,  $\text{Na}_2\text{H}_2\text{Sb}_2\text{O}_7 \cdot 6\text{H}_2\text{O}$ ,  $\text{NaMg}(\text{UO}_2)_3$  and  $(\text{C}_2\text{H}_3\text{O}_2)_9 \cdot 6\text{H}_2\text{O}$ .
- g) All carbonates are insoluble except those of sodium, potassium and ammonium. Magnesium carbonate is slightly soluble. Many hydrogen carbonates, such as  $\text{Ca}(\text{HCO}_3)_2$  and  $\text{Mg}(\text{HCO}_3)_2$ , are soluble.
- h) All phosphates are insoluble except those of sodium, potassium and ammonium. Some hydrogen phosphates, such as  $\text{Ca}(\text{H}_2\text{PO}_4)_2$ , are soluble.
- I) All sulfides are insoluble except those of ammonium, sodium, calcium, potassium, magnesium, barium and strontium. All of these are slightly hydrolyzed in water.
- j) All hydroxides and oxides are insoluble except those of sodium, potassium, ammonium and barium. Calcium and strontium hydroxides are slightly soluble. Magnesium hydroxide is only very slightly soluble.
- k) All arsenates are insoluble except those of sodium, potassium and ammonium