

4.3 Various Precipitation Reactions

Subject: Chemical reactions, precipitation reactions, net ionic equations

Description: Various clear solutions are mixed to form precipitates.

Materials:

<u>Reaction A:</u> ‡ 0.1M CuSO ₄ 0.1M Na ₂ CO ₃	<u>Reaction B:</u> ‡ 0.1M Fe(NO ₃) ₃ or FeCl ₃ 0.1M NaOH	<u>Reaction C:</u> ‡ 0.1M CuSO ₄ 0.1M CaCl ₂
<u>Reaction D:</u> ‡ 0.1M KI or NI 0.1M Pb(NO ₃) ₂	<u>Reaction E:</u> ‡ 0.1M Na ₂ CO ₃ 0.1M FeCl ₃	<u>Reaction F:</u> ‡ 0.1M AgNO ₃ 0.1M KCl or KI

For each reaction A-F the following supplies are located in the bin:

2 100 mL beakers

1 300 mL beaker

<u>Reaction G:</u> Solid KI or NaI‡ Solid NaNO ₃ or KNO ₃ ‡ 0.1M Pb(NO ₃) ₂ ‡ Supplies in bin: 2 300 mL beakers 2 watch glasses 2 spatulas
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‡Solutions for all reactions are stored in the solutions cabinets. Sodium hydroxide is stored in the cabinet under the hood.

Preparation:

1. Rinse all beakers thoroughly with dI water. Be sure to pre-label all beakers to avoid confusion

Procedure:

1. For reactions A-F: Pour each individual solution into a pre-labeled 100 mL beaker.
 2. Pour the contents of both beakers simultaneously into the 300 mL beaker to form the precipitate. See reactions below.

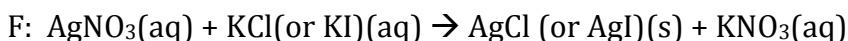
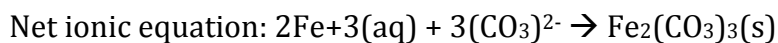
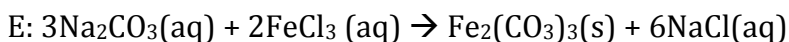
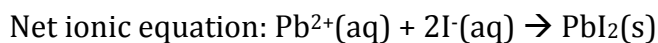
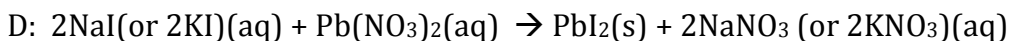
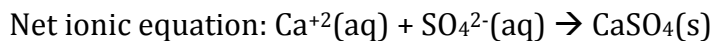
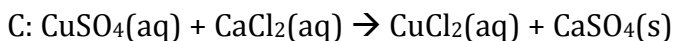
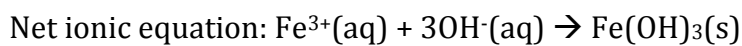
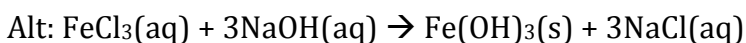
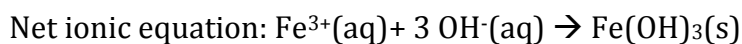
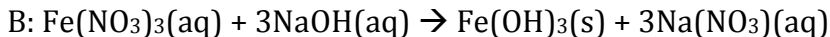
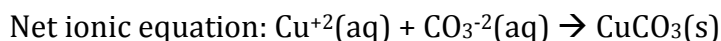
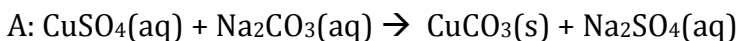
For Reaction G:

1. Place a few scoops of NaI and NaNO₃ on labeled watch glasses.

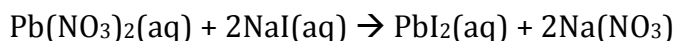
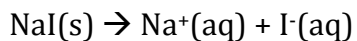
- Pour $\text{Pb}(\text{NO}_3)_2$ into each 300 mL beaker. Add NaNO_3 to first beaker. No reaction.
- Add NaI or KI to second beaker. A yellow precipitate of lead iodide will precipitate.

Discussion:

A precipitation reaction produces a water-insoluble solid product called a precipitate. The reactants are generally water-soluble ionic compounds that dissolve to produce an aqueous solution of anions and cations. When the cation from one reactant can form an insoluble compound with the anion of another reactant, a precipitation reaction occurs. Detailed below are the reactions for demos A-G.



G: $\text{Pb}(\text{NO}_3)_2(\text{aq}) + \text{NaNO}_3 \rightarrow$ no reaction. Both reactants are nitrate salts, which are water-soluble. No precipitation occurs.



Net Ionic equation: $\text{Pb}^{2+}(\text{aq}) + 2\text{I}^{-}(\text{aq}) \rightarrow \text{PbI}_2(\text{s})$

Safety: Lead is toxic. Silver nitrate can cause skin irritations. Sodium hydroxide is caustic and can cause skin irritations or burns. Use appropriate protective equipment, including gloves and safety glasses.

Disposal: Dispose of solutions in proper aqueous waste containers. The solution containing iron hydroxide from reaction B can be saved and reused for Demo 4.10 – Hydroxide Clean-up. The solution containing iron carbonate from reaction E can be saved and reused for Demo 4.4 – Carbonates in acid.

References:

1. Prof. Botch