

#### 4.10 Hydroxide Clean-up {Cu(OH)<sub>2</sub>, Mg(OH)<sub>2</sub>, Fe(OH)<sub>3</sub>}

**Subject:** Acid/base, solubility

**Description:** Demonstration of how to clean up insoluble metal hydroxides in a solution with addition of acid. The copper hydroxide solution made in demo 4.2 or the iron hydroxide solution made in demo 4.4 can be used for this reaction. Milk of Magnesia is used in the second reaction.

**Materials:**

Use one or all three of the following hydroxides:

Beaker containing copper hydroxide, Cu(OH)<sub>2</sub> (from Demo 4.2 or see below for preparation)

Iron hydroxide, Fe(OH)<sub>3</sub> (see below for preparation)

Milk of Magnesium commercial product (Mg(OH)<sub>2</sub>) ‡

2 250 mL beaker

100 mL beaker (for magnesium hydroxide)

Stir plate\*

3 Stir bars

1M HCl‡ in 300 mL beaker

6M HCl‡ in 100 mL beaker

‡HCl and NaOH are located in the cabinets under the hood. Copper and iron chloride salts are located in the general chemical storage cabinet.

**Pre-class Preparation:**

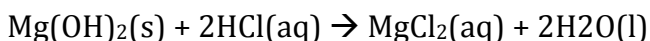
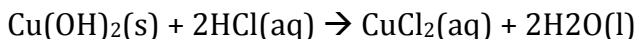
1. Pre-label all beakers to avoid confusion.
2. If making the solutions, produce the copper and/or iron hydroxide solutions as follows:
  - Add 0.1 M sodium hydroxide‡ to a 0.1M copper chloride‡ solution in a 250 ml beaker to get a copper hydroxide precipitate.
  - Add 0.1M sodium hydroxide‡ to a 0.1M iron chloride‡ or iron nitrate‡ solution in a 250 ml beaker to get a precipitate of iron hydroxide.

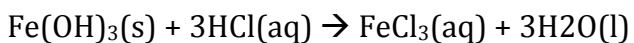
**Procedure:**

1. Place a stir bar in the beaker containing the hydroxide and stir on a stir plate.
2. Slowly add 1M HCl until solution becomes transparent. (If the reaction goes slowly, use the 6M HCl.)
3. Repeat with the magnesium hydroxide and the iron hydroxide.

**Discussion:**

The reactions of hydroxides with hydrochloric acid are given below:





The above hydroxide compounds are insoluble in water. Reactions with a strong acid produce the chloride salts. From our solubility rules, we know that the chloride salts of the above compounds are soluble in water and they dissociate completely, which has the result of clearing up the solution.

**Safety:** Hydrochloric acid is corrosive and may cause burns. Solutions of iron and copper chloride are corrosive and may irritate skin or cause burns. Use proper protective equipment including gloves and safety glasses.

**Disposal:** Solutions of copper and iron chloride should be disposed of in an appropriate waste container.

Magnesium chloride solution can be washed down the drain with water.

**References:**

1. L. Summerlin, C. Borgford; J. Ealy; *Chemical Demonstrations: A Sourcebook for Teachers*; Volume 2; 1987; p. 171