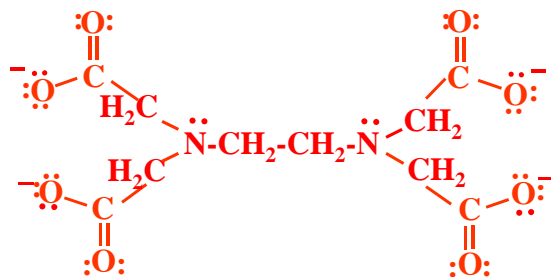


What is EDTA?

Tutorial 3 is due 10/26



Ethylenediaminetetraacetate



An acidic solution weakens the chelating power of EDTA

Correction: Only one “m” in ethylenediamine, but ligand NH_3 (ammonia) is called ammine

Reaction of Cu^{2+} with OH^{-}

After addition of EDTA

Step 8 When $CuSO_4$ dissolves in water:

Step 10 When 1 d of NaOH is added:

Step 11 More NaOH is added:

Reaction of Cu^{2+} with NH_3

After addition of EDTA

Step 12 When 1 M NH_3 is added:

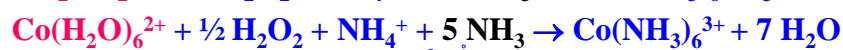
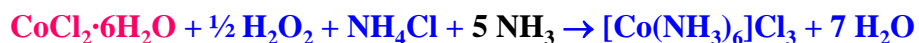
Chem 151 Lecture 8

EXP 6

Preparation and Spectroscopy of Complex Ions

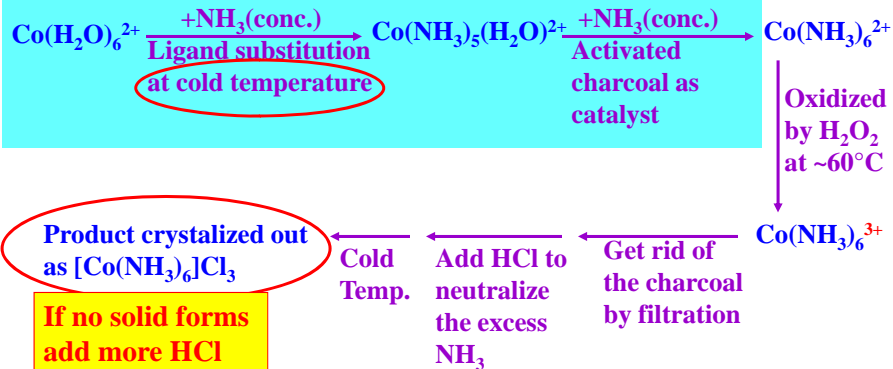
1. Synthesis of $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$
2. Synthesis of $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$
3. Scan the absorption spectra for the cobalt and the copper complex ions
4. Stoichiometric calculation to find the % yield of the synthesis product.

A. Synthesis of $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ from $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$



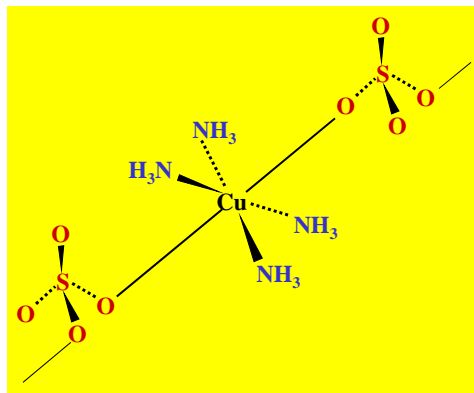
Is this a redox reaction?

Which substance is the oxidizing agent?



B. Synthesis of $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$ from $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

CuSO_4 dissolves in water to become $\text{Cu}(\text{H}_2\text{O})_6^{2+}$ and SO_4^{2-}



add isopropyl alcohol

$[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot \text{H}_2\text{O}$
crystal

C. Absorption Spectra of Complex ions $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot \text{H}_2\text{O}$

What is the major complex when $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ is added to water?

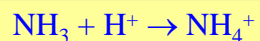


However, when $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$ is added to water?



Copper complexes turn into $\text{Cu}(\text{OH})_2$ ppt.

What happens when $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$ is added to an acid?



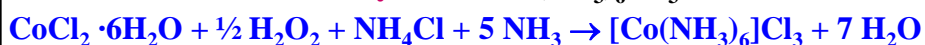
The Percentage Yield of a Synthesis

$$\text{percentage yield} = \frac{\text{actual yield}}{\text{theoretical yield}} \times 100\%$$

From experiment
From calculation

Theoretically, how much $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ can be produced?

What is the **theoretical yield** of $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$?



You add:
 0.07xx g of NH_4Cl
 0.1xxx g of $\text{CoCl}_2 \cdot 6\text{H}_2\text{O}$
 1.50 mL of 3.0% H_2O_2
 excess aqueous NH_3
 } \Rightarrow mole

Which reactant limits the amount of product produced?

Which reactant is the **limiting reagent** of the reaction?

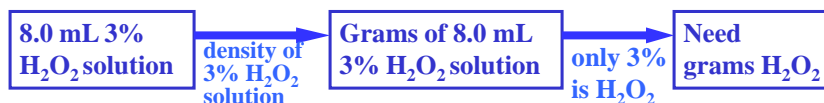
Use the limiting reagent to calculate theoretical yield

To calculate moles of H_2O_2 in a 3% solution:

$$\text{moles of } x = \frac{\text{mass of } x \text{ in gram}}{\text{molar mass of } x \text{ in g/mol}}$$

For solutions,
Mole of $x = M_x V_{\text{soln in L}}$

How many moles of H_2O_2 in 8.0 mL of 3.0% H_2O_2 solution?



Assume same as water = 1.0 g/mL

$$\text{mass of } 8.0 \text{ mL } \text{H}_2\text{O}_2 \text{ soln} = (8.0 \text{ mL soln}) \left(\frac{1.0 \text{ gram}}{\text{mL}} \right) = 8.0 \text{ g soln}$$

$$\text{mass of } \text{H}_2\text{O}_2 \text{ in soln} = 8.0 \text{ g soln} \times 3.0\% = 0.24 \text{ g } \text{H}_2\text{O}_2$$

$$\text{moles of } \text{H}_2\text{O}_2 \text{ in soln} = \left(\frac{0.24 \text{ gram } \text{H}_2\text{O}_2}{34.0 \text{ g/mol}} \right) = 0.0071 \text{ mol } \text{H}_2\text{O}_2$$

Read Tutorial 4 before coming to next lecture