Inorganic Chemistry Laboratory Report - Copper(II) Complexes

Name:_____ Lab section (day):_____ Date:_____

A. Tetraamminecopper(II) Sulfate Monohydrate

1. Calculate the percent yield of the product.

2. The possible coordination geometries around copper in $Cu(NH_3)_4^{2+}$ span a continuum from square planar to tetrahedral. Square planar coordination produces a much larger gap between the d orbitals of the complex than does tetrahedral coordination. The color of the complex arises from excitation of an electron from one d orbital to a higher energy d orbital. Given this fact, and the fact that most d-d electronic transitions occur in the visible region, which coordination geometry (tetrahedral or square planar) do you think is more likely for $Cu(NH_3)_4^{2+}$? Provide a brief rationale for your answer. Note: the color of the complex arises from light that is *not* absorbed.

3. How does the infrared spectrum of the product show the presence of ammonia? You should be able to identify both stretching and bending vibrations from N-H, as well as evidence of hydrogen bonding in the compound.

4. Identify the infrared bands associated with S-O stretching and bending from the sulfate counterion.

B. Diethylammonium Tetrachlorocuprate(II)

1. Calculate the percent yield of diethylammonium tetrachlorocuprate(II).

2. Decide, on the basis of the absorption maxima for the d-d transitions of the low- and high-temperature forms of the complex, which is tetrahedral and which is square-planar. Provide a brief rationale for your choice.

3. Assign the infrared bands that are due to C-H stretching, N-H stretching, and N-H bending.

4. Decide, on the basis of the N-H stretching region of the infrared spectra of the two forms of the complex, which contains the stronger hydrogen bonding. Provide an explanation of your reasoning.