Lab Report 1:

Synthesis and characterization of $[Co(NH_3)_4CO_3]NO_3$ and $[Co(NH_3)_5Cl]Cl_2$

The laboratory report should be in an ACS style and include a title page, an abstract, introduction, experimental, results and discussion, and references (primary). Follow the guidelines given in the handouts, course webpage, and consult the ACS style guide. Figures and Tables are to be numbered, have descriptive captions, and be cited in the text. Check spelling, verb tenses, and grammar. Use consistent and correct reference format. Items for the results and discussion include the calculation for the product yields (using significant figures), interpretation of the IR spectra and assignment of peaks, interpretation of the UV-Vis spectra (wavelength of maximum absorption, molar absorptivity, Spectrochemical series, etc.), interpretation and explanation of the molar conductivities.

Compare the starting material and the synthesized compounds and determine if the syntheses were successful. Support your claims with an interpretation of the experimental data. Citations to the primary and secondary literature are required to support claims. If you need a certain paper from the primary literature, you can request it from me and I'll provide it if I have it, otherwise request it through the UNF interlibrary loan. Turn in both a printed copy with the written text at the front and the labeled and organized spectroscopic data at the end. Also submit an electronic copy of the written portion of the laboratory report via e-mail or flash drive.

The following problems and questions, given below, are starting points and a guide for consideration of the results and discussion section in your laboratory report.

1. Balance the following chemical reaction,
$\_Co(NO_3)_2 + \_NH_3(aq) + \_(NH_4)_2CO_3 + \_H_2O_2 \rightarrow \_[Co(NH_3)_4CO_3]NO_3 + \_NH_4NO_3 + \_H_2O$
2. What is the purpose of each reagent in the reactions? Why is it included?
3. Draw the most likely structures of $Co(NO_3)_2 \cdot 6H_2O$, $[Co(NH_3)_5Cl]Cl_2$, and $[Co(NH_3)_4CO_3]NO_3$. Name each of the compounds.
4. What is the limiting reagent in the reaction? Calculate the theoretical yield and percent yield of $[Co(NH_3)_4CO_3]NO_3$ and $[Co(NH_3)_5Cl]Cl_2$. Be sure to consider the significant figures involved in the weighing of the reactants. Comment on possible reasons as to why the percent yield is not exactly 100%.
5. How can you maximize the purity of each synthesized compound?
6. Note colors and relate to the UV-visible spectra. Explain how these observations are related to the spectrochemical series and Δ_o and the factors that affect the crystal field stabilization energy.
7. Explain the magnitude of the molar absorptivity and the relation to the type of electronic transition and corresponding molecular structure. See section 20.7, Housecroft and Sharpe.
8. Explain the differences you observe in the conductance of the solutions and molar conductivities of: DI water, tap water, KCl, $MgCl_2$, $FeCl_3$, $[Co(NH_3)_4CO_3]NO_3$ and $[Co(NH_3)_5Cl]Cl_2$.
9. Did your synthesis produce the desired product? Support your answer using the evidence obtained from an analysis of the experimental data (i.e. IR, UV-Vis, conductivity, etc).
10. Propose a chemical procedure to analyze $[Co(NH_3)_5Cl]Cl_2$ for the percentage Cl content.