Quantitative Analysis Laboratory, CHEM 214
Summer 2012 Syllabus

Quantitative Analysis Laboratory (1 credit hour)
Prerequisite: Chem 106/102 and 112; Chem 222/224 and 226 as well as completion of lecture Chem 212.

Instructor: Dr. Conrad Naleway
Office: Flanner Hall 200C
Office Phone: (773) 508-3115
Email: cnalewa@luc.edu
Office Hours: During, Just Prior and After Lab

Teaching Fellow: Matthew Reichert
Office: Flanner Hall 101
Email: mreichert@luc.edu
Laboratory Hours: MTWTh 12:30-3:20
TA Office hours: TBD

Objectives:

1) To acquaint students with some of the classical and modern techniques in analytical chemistry
2) To teach wet chemical lab skills, efficiency and planning of experiments
3) To teach critical evaluation of experimental results
4) To become familiar with conventional data collection in commercial and academic laboratories.

Attendance:

Students are expected to be in attendance for all labs unless told otherwise. Make-up exams and quizzes will not be allowed unless previously discussed with the Instructor of Teaching Fellow. The schedule is very packed and missing a lab may make it difficult for the student to stay caught up with the rest of the class.

Laboratory Procedures:

It is the responsibility of the student to print out all lab procedures and have them available for use during each lab. At the start of each lab period, the procedures and goals for the day will be discussed. Students will also be informed of any specific hazards, waste disposal, and other safety and equipment related concerns. Students may also be given additional handouts that are pertinent to each lab assignment.

It is expected that the student come to lab prepared having read the procedure. It is required that students have lab notebooks. Prior to lab students should summarize the purpose and procedures for the lab to acquaint them with the methods which will be utilized throughout the lab experiment and to assist them in planning so the time spent in lab is used effectively. **Lab notebooks will be collected toward the end of the semester to be graded.** Pre-lab quizzes will also be given to assess the preparedness of the individuals prior to the start of each experiment. If it is believed that the student is not adequately prepared to complete the lab, they will be removed from the lab for additional instruction.

In most cases a standard unknown sample whose composition is known to at least **FOUR** significant figures will be assigned. The concentration of the unknown sample will be determined by the student, and a grade will be assigned based on how accurately the determinations reflect its true composition. Good precision ($\leq$ 5 ppt) must be maintained throughout all steps of a lab.

For each assignment, report the values of the individual determinations, the mean concentration (or percent composition) and the standard deviation associated with the overall determination. Each lab may be repeated only once in order to get a better grade. However, a new unknown sample must be used and it must be

undertaken in the time frame established on the laboratory schedule. Report the results and calculations on BLACKBOARD as soon as completed. Results may be submitted on paper during lab as well for faster grading, but all final lab experiment grades will be assigned based on submissions to BLACKBOARD. If a lab was repeated, the accuracy grade will be the better of the two results. Accuracy accounts for about 60% of the overall grade (see breakdown below).

Laboratory reports are required from all students for all labs unless otherwise specified. The purpose of the reports is to familiarize students with the aspects of technical writing in the context of critically analyzing what was done in lab. The laboratory report should present what was done, results, conclusions and analysis of the data in a logical and cohesive manner allowing anyone the ability to pick up the lab report and understand what was done.

Laboratory reports are to be computer generated. The suggested report format found in a second handout can serve as guidance for writing the laboratory report. Graded lab reports will determine about 21% of the overall grade (see breakdown below). **Lab reports turned in late will receive a penalty of 10% each day the report is late and result in a grade of 0 if not received within one week of the established due date.** Lab reports **will not** be accepted via email unless otherwise specified.

Two exams will be given over the course of the semester which cover materials in each of the immediately preceding experiments. The midterm exam will include **Experiments 1-3** and the Final Exam will include **Experiments 4-7**. The questions will cover the theory as well as related calculations.

Lab Quizzes will also be a part of the overall grade. **Before the start of each experiment a quiz will be given**. Questions will generally come from the procedure or calculations related to the lab. In some instances, questions will be asked which do not come from the procedure. These questions will dig a little deeper into certain aspects of the lab and can be answered with little additional reading outside of the procedure itself. **Quizzes will be given during the first 15 minutes of lab. You MUST be punctual in getting to lab on-time; there will be NO excuses! If you arrive late to lab, you will NOT be allowed extra time to complete the quiz.**

Finally, a portion of the overall grade will be eared from an exercise utilizing Excel. The assignment is designed to familiarize the student with Excel and the role it can play in data collection, organization, calculations, and analysis. While this exercise may be contrived, it is important that the student be familiar with the usage of a program such as Excel if he or she has any intention of further work in the sciences, be it other undergraduate level classes, graduate school, and/or a career in the sciences.

Other Materials:

As previous mentioned, it is required that a bound (NO SPIRAL) laboratory notebook be used by each student for procedures, observations, data collection, calculations, etc. relating to each laboratory experiment. It is important that lab notebooks be detailed and organized. **Lab notebooks will be collected toward the end of the semester for grading.** Access to an inexpensive calculator having logarithmic, exponential, and trig functions is also suggested. Lab goggles are **required** to be worn in the lab at all times. All items must be brought to every lab session. In some instances it may be advantageous to have a laptop computer in lab for immediate data entry, analysis and calculations. If it is deemed to be a distraction or hazard, the TA or Lab

Instructor may request that it be put away. Please note that cell phones are not a substitute for a calculator and will NOT be allowed for use during quizzes, the midterm, or final exam.

Academic Honesty

While it is encouraged that students work together, cheating will not be tolerated. Please review Loyola University Chicago policy on Academic Integrity through the following link: http://www.luc.edu/academics/catalog/undergrad/reg_academicintegrity.shtml.

Grading Policy

The grading policy established here is subject to change at the discretion of the Professor and/or the Teaching Fellow.

Grading Category	Pts	Percent
Analytical Findings (Accuracy)	**1400**	60.1 %
Detailed Laboratory Reports (6 @ 75 pts each, 1 @ 50 pts)	**500**	21.5 %
Lab Quizzes (7 @ 10 pts each)	**70**	3.0 %
Excel Exercise	**60**	2.6 %
Midterm exam	**100**	4.3 %
Lab Notebook	**100**	4.3 %
Final exam	**100**	4.3 %
Total	**2330**	100.1 %

Grade Assignment:

Points	
2007 – 2330	**A**
1864 – 2006	**B**
1631 – 1863	**C**
1398 – 1630	**D**
Below 1398	**F**

General Guidelines for Laboratory Reports and Suggested Format
CHEM 214: Quantitative Analysis Laboratory

Lab reports for Quantitative Analysis should be more complete, accurate, and detailed than reports done in the past for General Chemistry or Organic Chemistry. This is an upper division level science class, and more thoroughness is expected of the student. Lab reports should be written such that anyone can be given the report and, after reading it, understand what was done and be able to reproduce what was done.

Lab reports will generally consist of the following elements:

Title page – The title page should contain the name of the lab experiment, the student's name, the name of the lab partner(s) (if applicable), the date the report is due, and the purpose statement. The purpose statement should briefly and specifically describe the goals of the experiment.

Methods – This is an explanation of how the lab was originally written to be completed, the steps the student took to complete the lab, and any modifications to the procedures. Exact masses and volumes used by the student should not be used in this section. All chemicals used as well as important laboratory equipment should also be included. This section should be written in the students own words. ***Do not plagiarize!***

- It must be so clear that anyone not familiar with the lab would know exactly what to do.
- Be careful how prep instructions for solutions are written. There is a difference between "Completely dissolve 12 g KOH in 500 mL of water in a 500 mL volumetric flask" and "Completely dissolve 12 g KOH in 300 mL DI water, dilute up to 500 mL mark, and shake to mix well.

Results and Discussion – The Results and Discussion section(s) should demonstrate that the student understands the results and can interpret them properly. Calculations should be included as well as full detailed explanations of possible sources of error and how it affects the results of the experiment. Suggestions to improve experimental results and/or methodology should also be included.

- Multiple trials will always be done to verify data as having good precision. All data must be shown, including repeat lab data (if available). **The Teaching Fellow will grade lab reports based on precision.**
- Data should be presented in table format with appropriate column and row headings and include the individually determined values, averages (for concentrations, percents, unknowns, etc.), standard deviations, and other necessary values. When applicable include units in column headings i.e. "NaOH volume (mL)" or "mL of NaOH." Tables must be labeled with appropriate brief titles describing the contents within a table directly above the table (For example: Table 1: Data for determining the molar concentration of NaOH standardized with KHP and results).
- Statistical analysis of your data should also be put in this section.
- If applicable, graphs should go in this section, and they must be clearly labeled with a title and proper x-axis and y-axis names as well as units. Graphs should be done in Excel. If graphs or figures are included, such as spectra or chromatograms, they should be accompanied with a proper label i.e. Figure 1, and brief description directly below it.
- Include calculations in this section with appropriate units, chemicals and properly identifying what is being calculated and the trial # the calculation is being completed for. The calculations may be written, but please write them neatly so they can be read and understood.
- Include a **detailed** analysis of error (at least 3 errors). This should be done based on the students own data and results.

- How does the error change the outcome (concentration higher/lower than it should be, etc.)? How does the error affect the subsequent steps in the experiment?

Conclusions – Conclusions should be a brief summary of what was done, the results, and any other important things to consider.

Additional Considerations

- Order is also important for excellent scientific work – the lab report write-up should follow the order listed on these directions or a similar format.
- Page numbers should be present on all pages of the lab report with the exception of the Title Page.
- All parts of this report must be typed (calculations are an exception). Please use at least 11 point font, 1.5 lines spacing for paragraphs, and 1 inch margins.
- Please keep entire tables on a single page. If you must split up a table, remember to include column and row headings again.
- Reports should have good spelling, sentence structure, etc. Do not use run-on sentences, sentence fragments, or misspelled words. **Do not** use personal pronouns (I, we, me, etc.).
- Take the time to check over your work and re-read your report to make sure that what you wrote is clear and makes sense.

The following has been said:

- A student could do mediocre work and write up an excellent lab report, and the work will be thought of as wonderful. A student could do wonderful work and write it up poorly, and the work will be thought of as mediocre.

The lab report write-up is a **VERY IMPORTANT** part of a laboratory based course, especially at the junior/senior undergraduate level and, of course, for graduate level work.

Lab Report Grading Rubric

The following is a rough guideline of how points will be assigned on your lab reports. Redistribution of points from the outline below may occur from lab to lab at the discretion of the Teaching Fellow. Six of the seven lab reports will be out of 75 total points. The seventh lab report will be out of 50 total points.

Lab Report Categories	**Points**
Title Page	5
Methods	12
Results and Discussion	45
Conclusions	5
Grammar	8
TOTAL	**75**