CHM 4411L, Physical Chemistry Laboratory
Summer, 2013

Instructor: Dr. Kathryn R. Williams, CLB 220, 392-7369, krw@chem.ufl.edu
Office Hours: M,12-1PM; W,12-1PM; Th,9-10AM; F,8-9AM

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Office Hours: M, 9-10AM; F,9-10AM

Objectives: CHM 4411L focuses on measurements of thermodynamic, kinetic, and spectroscopic properties; error analysis and critical examination of results; and preparation of results in written and oral format.

Texts: Williams, K.R. *Error Analysis in Physical and Analytical Chemistry*, 3rd ed.; University Copy and More: Gainesville, 2008.

Williams, K.R. *Experiments for Physical Chemistry*, Summer 2013, Target Copy: Gainesville, 2013.

Other Required Materials: Laboratory Notebook with duplicate pre-numbered pages; safety glasses; departmentally approved attire; flash drive

Grade Distribution:

Problem Set:	1 (due noon, Wednesday, 5/22/13, CLB 220) @ 50 pts.	50 pts.
Written Reports:	3 full reports (Keto/Enol, HCl/DCl & I_2 LIF) @ 100 pts	300 pts.
	7 abbreviated reports @ 50 pts	350 pts.
	1 Molecular Modeling/Library assignment @ 50 pts	50 pts.
Oral Reports:	1 experiment @ 50 pts	50 pts.
Prelab Exercise:	10 @ 10 pts (none for Molecular Modeling)	100 pts.
Subjective Grade:		100 pts.
Total		**1000 pts.**

Factors affecting the subjective grade will be the student's attendance record (lecture and lab), preparation for laboratory work, laboratory technique, understanding of the experiments, and general attitude. Students are expected to arrive on time for all lectures and labs. Deductions for late written work and lecture absences will be assessed as follows:

Missed lecture (or late arrival) :	-10 subjective points per lecture
Late report (due at the start of lab):	-5% per day (including weekends)
Late prelab (due at the start of lab):	not accepted; zero points given

Grading Scale (in % using usual rounding conventions for fractions):
>90/A; 87-89/A-; 84-86/B+; 80-83/B; 77-79/B-; 72-76/C+; 67-71/C; 64-66/C-; 57-63/D+; 54-56/D; <56/E
Note: Chemistry majors earning grades below C (C-, D+, D, or E) must repeat the course to earn credit towards the degree.

Registration Policy: CHM 4411L is a high-demand course for chemistry majors. You are expected to complete the course within a single semester. Students who drop after the end of drop/add, or who do not earn at least a C, will have low priority for future registration.

Written Reports: Except for equations, laboratory reports must be double-space typed using a minimum font size of 12 point. Equations (both mathematical and chemical) should be handwritten, unless you are experienced in the use of an equation editor. Reports should contain the sections described below.

Full Reports

I. Abstract: The abstract (250 words max) should give a summary of the entire experiment: what was measured, experimental method, results with 95% confidence limits, important conclusions. The abstract must be complete in itself, although it is separate from the rest of the paper.

II. Introduction: This section should answer the questions: 1) What is the reason for performing this experiment; 2) What is the theory supporting the experiment; and 3) What is the methodology used? The second point will constitute the major part of the introduction. Give equations unique to the experiment and conditions necessary for the equations to be valid. Identify all variables with their units. Number equations consecutively in the right margin, and refer to the original number if the equation is used again (e.g., in the Sample Calculations). Also include molecular structures for pertinent compounds (other than macromolecules). In writing this section, aim to explain the experiment to a senior-level chemistry student who has taken physical chemistry, but who is otherwise unfamiliar with the procedure or method. Try not to copy the introductory material in the text or handout.

III. Experimental Procedure: The procedure should be clearly explained in paragraph form in sufficient detail that a person trained on the instrument could repeat the experiment. Use the passive voice (no commands). Include the manufacturer and model name/number for each instrument used. Also, be sure to include a reference to the laboratory manual.

IV. Calculations: Give a sample calculation with actual data (including units) to show how results are obtained. Include text as needed to explain what is involved; do not just write out a series of equations.

V. Error Analysis: Include a mathematical analysis of the random errors in the experiment. Include text as needed to explain what is involved; do not just write out a series of equations.

VI. Data and Results: Use a spreadsheet program (e.g. Excel) to prepare graphs, making sure that you obey general rules for graph drawing. Tables should contain all necessary data and results, but not intermediate calculations (i.e., no "spreadsheet dumps"). Also include introductory text to direct the reader to the tables and graphs, to specify experimental parameters (e.g., temperature) held constant throughout the experiment, and to explain symbols, etc. The table summarizing the final results should include available literature values. Guidelines for tables and graphs are given in Young, V.Y. *Laboratory Manual for Introductory Analytical Chemistry*, pp5-8, and in the *ACS Style Guide* available at http://pubs.acs.org/userimages/ContentEditor/1246030496632/chapter14.pdf

VII. Conclusions and Discussion: This is the most important section of the report and should not be taken lightly. Referring to your summary table, evaluate the quality of your results (i.e., Do the error limits for the measured value include the accepted value?). Relate the experimental results to the chemistry of the system (what did you learn from the experiment?). Discuss pertinent sources of error and their effects on the results. If possible, make suggestions for improvements.

VIII. References: Special procedures, literature values, and discussions of previous research results must be referenced in the text using superscript numbers. The references themselves belong in a separate section at the end of the report using the format specified in the "Author Guidelines" download from The ACS Style Guide, 3rd edition: http://pubs.acs.org/page/books/styleguide/index.html. (Note: The laboratory manual should be referenced as shown on the first page of this syllabus.)

Abbreviated Reports

I. Abstract: Same as full reports.

II. Experimental Procedure: Reference the procedure in the laboratory manual and state any alterations. For each instrument, give the manufacturer's name and model number.

III. Calculations: Give sample calculations using actual data and units. Give an appropriate header for each.

IV. Error Analysis: Show necessary mathematical operations using actual data and units. Give an appropriate header for each.

V. Data and Results; VI. Conclusion and Discussion; VII. References: Same as full reports.

**** It is expected that reports will be neat and written in good English, with proper attention paid to paragraph structure, grammar, spelling, etc. Substandard reports will be rewritten (with appropriate point deductions).

Oral Reports: There will be an oral presentation of one of the experiments (specified by the instructor). Organize your talk to fit a 20-minute time block (typical length at an ACS meeting, etc.) and use transparencies or PowerPoint to facilitate the presentation. You should approach an oral report as a job or graduate school interview and dress accordingly.

Students with Disabilities: Appropriate accommodations will be provided, according to the policy at www.chem.ufl.edu/~itl/disabilities.html.

Academic Honesty: Students are expected to obey the University of Florida Honor Code, detailed at www.chem.ufl.edu/~itl/honor.html. Violations will be reported to the Office of Student Judicial Affairs.

Schedule of Experiments and Reports: On the schedule below, letters A, B, C, D refer to student groups to be assigned on the first day of lab. Each student will write 3 full reports, 7 abbreviated reports, and the molecular modeling and library assignments. The oral reports will be presented on August 6. Written reports must be submitted at 12:30 on the designated dates. Deductions at the rate of 5% per day (including weekends) will be assessed for late work. All written work (late or otherwise) must be received by 5:00 PM, Friday, August 2, 2013.

Day	**Lecture**	**Experiment**	**Report Type**	**Report Due Date**
5/14	Error Propagation; Keto/Enol Tautomerism; Problem Set assigned	Keto/Enol Tautomerism	Full	5/21; HW, 5/22[a]
5/21	Least Squares Analysis	A. Bomb Calorimetry B. Hydrolysis Kinetics C. Phase Diagram D. Conductivity & Trans. #'s	Abbr	5/28
5/28	HCl/DCl	A. Kinetics; B. Bomb; C. Conductivity; D. Phase	Abbr	6/5
6/4	HCl/DCl	HCl/DCl (including calculations)	Full	6/12
6/11	Library Resources (Denise Bennett in Marston 308)	Molecular Modeling and Library Search Exercise	Abbr	6/18
6/18	Raman Spectroscopy	Raman Spectroscopy	Abbr	7/2
June 25, Semester Break				
7/2	Laser-Induced Fluorescence	A. Phase; B. Conductivity; C. Bomb; D. Kinetics	Abbr	7/9
7/9	Laser-Induced Fluorescence	A. Conductivity; B. Phase; C. Kinetics; D. Bomb	Abbr	7/16
7/16	C_P/C_V	Laser-Induced Fluorescence (including calculations)	Full	7/23
7/23	Nuclear Chemistry	C_P/C_V by Spherical Resonator Method	Abbr	7/30
7/30	Effects of Radiation	Dosimetry	Abbr[b]	8/2 (Fri)
8/6	Oral Reports	Oral Reports		

[a]The first problem set is due at noon, Wednesday, May 22.

[b]The Dosimetry report is due by 5 PM, Fri, 8/2.