CHM 4413L, Biophysical Chemistry Laboratory
Fall 2013

Instructor: Dr. Benjamin J. Killian, LEI 202A, 392-0528, killian@chem.ufl.edu
Office Hours: Mon, 6th Per.; Tues, 4th Per.; Wed, 3rd Per

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Objectives: CHM 4413L students learn:
- Physical measurements of properties relating to biologically significant systems
- Error analysis and critical examination of experimental data
- Preparation of formal written reports and oral presentations

Texts: Williams, K.R. *Error Analysis in Physical and Analytical Chemistry*, Target Copy: Gainesville, 2008.

Killian, B. J. *Experiments for Biophysical Chemistry Laboratory*, Fall 2013, Target Copy: Gainesville, 2013.

Other Required Materials: Laboratory Notebook with duplicate pre-numbered pages; safety glasses; departmentally approved attire; diskette or memory stick

Grade Distribution:

Problem Set:	1 Error Analysis Problem Set @ 100 pts.	100 pts.
Written Reports:	4 full reports @ 100 pts.	400 pts.
	5 abbreviated reports @ 50 pts	250 pts.
Oral Reports:	1 @ 50 pts	50 pts.
Prelab Exercise:	10 @ 20 pts (10 pt. On-line, 10 pt. written)	200 pts.
Data Submission:	10 @ 10 pts	100 pts.
Subjective Grade:		100 pts.
Total		**1200 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. Ten (10) subjective points will be deducted for each unexcused absence from lecture. Random notebook "spot checks" will be conducted to check for written procedures and data collection.

Students are expected to arrive on time for all lectures and labs. Attendance will be recorded at the start of lecture. Pre-lab exercises must be submitted at the start of the laboratory period. No pre-lab assignments will be accepted after the beginning of lab.

Grading Scale (in % using usual rounding conventions for fractions):

Letter Grade	Percentage	Letter Grade	Percentage	Letter Grade	Percentage
A	>90	B-	>77	D+	>57
A-	>87	C+	>72	D	>54
B+	>84	C	>67	E	<54
B	>80	C-	>64		

Note: Chemistry majors earning grades below C (C-, D+, D, or E) must repeat the course to earn credit towards the degree.

Pre-Lab Assignments: For all experiments students will complete a pre-lab assignment. The written pre-lab assignment can be found in the lab manual at the end of the experimental write-up. The on-line pre-lab quizzes will be announced through Sakai. Students are expected to work independently on pre-labs. Please follow the same presentation guidelines as with reports; i.e., include units, format LLS equations, proper graph construction, etc. When a spreadsheet assignment is completed, please turn in a formatted print-out of your results and bring an electronic version of the spreadsheet to lab with you. **You must show example calculations on all pre-labs.** Pre-lab assignments are due at 12:50 PM on the day of the experiment. NO late pre-lab assignments will be accepted.

Data Submissions: One of the biggest stumbling blocks to 4413L students is timely preparation of lab reports. By putting off data analysis to the last minute students often present incomplete, incorrect, and poorly presented results and have little time to carefully construct report conclusions. Consequently, students are required to submit their data on the laptop computer in LEI 202 by the end of day on the Friday (Monday for the Friday lab) immediately following the experiment. You will be provided with an example of the file structure you will need to use for each experiment. This data submission process will help to ensure that you begin analyzing your data in a timely manner, and will aid in grading lab reports.

Written 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). Except for equations and abstracts, laboratory reports must be double-space typed using a minimum font size of 10 points. Please use a professional font, such as Times New Roman or Arial. Equations (both mathematical and chemical) should be generated using an equation editor. You may write equations by hand using black or blue ink; however, they must be clearly written with sufficient space to set them off from the text. Reports should contain the sections described below.

Full Reports

I. Abstract: The abstract (200 words max) should give a summary of the entire experiment: what was measured, experimental method, results with 95% confidence limits. The abstract must be complete in itself, although it is separate from the rest of the paper. Place the abstract (single spaced) on the title page, separate from the remainder of the report.

II. Introduction: This section should answer the questions: 1) What was the reason for performing this experiment; 2) What was the theory supporting the experiment?; and 3) What was 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, you should 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. Do not regurgitate 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, but do not give specific commands that were used. Use the passive voice (no commands), write in the past tense (tell me what you did), and do not write in the first person. 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 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 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 raw (uncorrected) data or intermediate calculations (include the data needed to obtain the final presented results only; i.e., no "spreadsheet dumps"). Guidelines for tables and graphs are given in Young, V. *Laboratory Manual for Introductory Analytical Chemistry*, pp. 5-8 (older versions, as well). Also include 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. Always report your LLS equations in the text. The table summarizing the final results should include (and cite) available literature values.

VII. Conclusions and Discussion: This is a very important section of the report and should not be taken lightly. Referring to your summary table, restate your final results and 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 *ACS Style Guide* (see http://jchemed.chem.wisc.edu/Journal/Authors/References.html for details). 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: Same as full reports.

VI. Conclusion and Discussion: Same as full reports.

VII. References: Same as full reports.

Chemical Structures and Equations: It is strongly recommended that you use electronic means of generating chemical structures and equations. Microsoft Office has a built-in equation editor. Several computer programs exist for building chemical structures. Symyx offers free academic software for generating chemical structures at http://www.symyx.com/downloads/downloadable/index.jsp. Note: you must register to download. Also, it is advised that you download a free chemistry font for use in your word processor. One example is the Royal Society of Chemistry font, found at http://www.rsc.org/education/teachers/learnnet/RSCfont.htm.

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.

The sale or transfer of graded or ungraded course materials to another student for use in this course (current or future semesters) is in violation of the Honor Code. All violations will be reported.

Schedule of Experiments and Reports: Written reports and pre-labs must be submitted by 12:50 PM one week from the date of experiment. All assignments submitted after 12:50 PM are considered late. Deductions at the rate of 5% per day (including weekends) will be assessed for late work. The maximum allowable late time is one calendar week, after which a grade of zero will be assigned.

Lecture		Laboratory			
Week of	Topic	Experiment			
		Team 1	Team 2	Team 3	Team 4
8/19	No Class	Lecture			
8/26	Error Analysis	*cis*/*trans* Equilibrium (Full A/B)			
9/2	No Class	Membrane Permeability (Abbr. A/B)			
9/9	Kinetics	CA (Full A)	EK (Full B)	EST (Full A)	BR (Full B)
9/16	Kinetics	ASP (Abbr. A/B)	CA (Full A)	EK (Full B)	EST (Full A)
9/23	Phase Diagram	BREAK	ASP (Abbr. A/B)	CA (Full A)	EK (Full B)
9/30	Binding	PD (Abbr. A/B)	BREAK	ASP (Abbr. A/B)	CA (Full A)
10/7	Binding	BR (Full B)	PD (Abbr. A/B)	BREAK	ASP (Abbr. A/B)
10/14	Binding/pKa	EST (Full A)	BR (Full B)	PD (Abbr. A/B)	BREAK
10/21	pKa	EK (Full B)	EST (Full A)	BR (Full B)	PD (Abbr. A/B)
10/28	pKa Quiz	pKa†			
11/4	Dosimetry	No Lab (Homecoming)			
11/11	No Class	Fricke Dosimetry			
11/18	Dosimetry/ PIB	Conjugated Dyes			
11/25	Nuclear	No Lab (Turkey Day)			
12/2	Nuclear	No Lab (Reading Days)			

*The pKa report is due two weeks from the date of the experiment.

KEY: EK = Enzyme Kinetics; EST = Estradiol Binding; BR = Bilirubin Binding; PD = Phase Diagram; CA = Carbonic Anhydrase; ASP = Aspartame Kinetics