**Physical Chemistry Laboratory - Spring 2017**
CHEM 417
Room CSL-222

**Instructor**:
Section 01: TTh 8:00-10:40;
Dr. Karen Peterson
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Office hours: M/W 10:00-11:00 am

Section 02: TTh 2:00-4:40
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Office hours: T/Th 12:45-1:30,
W 1:00-2:30

**Text**: "Physical Chemistry Laboratory Manual"; purchase this in the SDSU bookstore
Other texts, such as those used for Chem 410A, 410B, and 251 may also be useful as references on theory and introductory laboratory techniques.
**Required Lab Notebook**: You will need a lab notebook with duplicate pages. This is available in the bookstore. The lab notebook will remain in the lab at all times.

Catalog Description
**CHEM 417. Advanced Physical Chemistry Laboratory**
Six hours of laboratory.
Prerequisites: Chemistry 251, 410A, and credit or concurrent registration in Chemistry 410B
Experimental physical chemistry. Emphasis on interpretation and statistical evaluation of instrument-derived results, record keeping, report writing and individual initiative in observing results.

**PROJECTS (700 total possible points):**

This course focuses on quantitatively measuring the physical and chemical properties of compounds and understanding the limits of accuracy and precision in these measurements. There is also a strong writing component, with regard to both the laboratory notebook and written reports. There will be seven experimental projects, an introductory assignment, and a final assignment. The following point distribution applies to each experimental project:

**Prelab quiz**: A quiz will be given at the beginning of lab on the first day of each project.
**5 pts** More details will be given in class.

**Notebook/lab work**: Requirements and expectations for your lab notebook and lab work are
**30 pts** given at the beginning of the lab manual.

**Report**: The lab reports must be typed, with figures and tables embedded. The manual
**45-65 pts** contains more details about how to write the report. Hand in a printed version of the report at the beginning of class. If you are having problems with printing, send the reports electronically to the instructor prior to class, and hand in a printed version by the next lab period.

**1 point for each day late will be subtracted for reports submitted after the deadline (the beginning of class, one week after the last lab period for the relevant project).**

**Progressive grading scheme**

There will be seven experimental projects in addition to an introductory and final assignment. The introductory assignment will take place the second and third lab periods. Each of the seven experimental projects is composed of a specific experiment. All seven experiments will be going on at the same time during the lab period, each assigned to a different team consisting of two people. Therefore, "Project 1", "Project 2", etc. will vary for each student. In order to gradually focus on different parts of the report, the project requirements will change as the semester progresses:

Introductory assignment: This assignment focusses on using the notebook and on error analysis. For the parts that involve lab work, the notebook will be graded.

Total of 35 pts

Project 1 and 2: No introduction or experimental section is required. The results section will only include tables, graphs, sample calculations, and final results. No writing is necessary in the results section. The discussion section will require writing of well-formed paragraphs.

5 pts Prelab quiz
30 pts Notebook/lab
35 pts Results (no text required)
10 pts Discussion

Total of 80 pts

Project 3, 4, and 5: No introduction or experimental section is required. The results section now must be complete with text used to present and explain the results. As before, tables, graphs, sample calculations and final results must be included. The discussion section will require writing of well-formed paragraphs.

5 pts Prelab quiz
30 pts Notebook/lab
45 pts Results
10 pts Discussion

Total of 90 pts

Project 6 and 7: These reports should be complete. The introduction and experimental sections are now required. The results section now must be complete with text used to present and explain the results. As before, tables, graphs, sample calculations and final results must be included. The discussion section will require writing of well-formed paragraphs.

5 pts Prelab quiz
10 pts Introduction/Experimental
30 pts Notebook/lab
45 pts Results
10 pts Discussion

Total of 100 pts

Final Assignment: Temperature Dependence of keto-enol equilibrium.
A worksheet will be given with NMR results collected during the semester (each group obtained data at a specific temperature). This project will not require a full report.

Total of 35 pts

**Attendance and Punctuality**
Attendance is mandatory: **10** points will be subtracted if you miss a lab period, unless you are completely finished with the lab work **and the analysis of the data**. Although you will be able to use your partner's data for any missed days, you will need to do a make-up lab to get those 10 points back. This involves a trial lab of the instructors choice which will take no more than a total of three hours. Only two labs can be made up in this way.

If you are late to lab by more than 10 minutes, 5 points will be deducted; more than 5 points may be deducted for egregious violation of punctuality.

The grading scheme for the course will be as follows:

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|---|---|---|---|
| A | 89-100% | C | 59-66% |
| A- | 85-89% | C- | 55-59% |
| B+ | 81-85% | D+ | 51-55% |
| B | 74-81% | D | 43-51% |
| B- | 70-74% | D- | 40-43% |
| C+ | 66-70% | F | < 40% |

Total points = 35 + 2(80) + 3(90) + 2(100) + 35 = 700

**List of Projects**
- Kinetics of Bimolecular Quenching of $Ru(bipy)_3^{2+}$ by Oxygen
- Biomimetic Fluorophores
- Solution Properties Determined by Surface Tension Measurements
- Prediction and Measurement of Infrared and Raman Spectroscopy
- Silver Nanoparticle Aggregation
- NMR Determination of Keto-Enol Equilibrium Constants
- Interpretation of the Visible Spectra of Polymethine Dyes

**LEARNING OUTCOMES**
At the end of this course, we expect that you will have learned the following:
- How to write clear and concise reports, including the preparation of tables and graphs
- Be able to record results and observations in a notebook in a complete and clear manner
- Be able to clearly present numerical results and estimate uncertainties in those results
- Develop a working knowledge of a variety of spectrometers (e.g., NMR, IR, Raman, Fluorescence, UV-Visible)
- Be able to analyze raw data to determine specific properties of compounds and molecules

*Add/Drop Procedure: The add/drop deadline is January 31, 2017. For details, see http://arweb.sdsu.edu/es/registrar/schedule_adjustment.html*

*Students with Disabilities:*
*If you are a student with a disability and believe you will need accommodations for this class, it is your responsibility to contact Student Disability Services at (619) 594-6473. To avoid any delay in the receipt of your accommodations, you should contact Student Disability Services as soon as possible. Please note that accommodations are not retroactive, and that I cannot provide accommodations based upon disability until I have received an accommodation letter from Student Disability Services. Your cooperation is appreciated.*

**Course Schedule (tentative – updates will be posted on blackboard) Spring 2017**

| Week of: | Tuesday | Thursday |
|---|---|---|
| Jan 16 | Classes start on Wed., Jan. 18 | Introduction<br>First day of class |
| Jan 23 | Introductory project.<br>Meet in CSL-222 | Introductory project.<br>Meet in CSL-222 |
| Jan 30 | Project #1<br>*Last day to add/drop* | Project #1 |
| Feb 6 | Project #1 | Constructing tables and figures. Meet in GMCS-245A. |
| Feb 13 | Project #2 | Project #2<br>**Project #1 report due** |
| Feb 20 | Project #2 | Project #3 |
| Feb 27 | Project #3<br>**Project #2 report due** | Project #3 |
| Mar 6 | Report writing – results section. Meet in GMCS-245A. | Project #4 |
| Mar 13 | Project #4<br>**Project #3 report due** | Project #4 |
| Mar 20 | Project #5 | Project #5<br>**Project #4 report due** |
| Mar 27 | SPRING BREAK | SPRING BREAK |
| Apr 3 | Project #5<br>*ACS conference* | Project #6<br>*ACS conference* |
| Apr 10 | Project #6<br>**Project #5 report due** | Project #6 |
| Apr 17 | Report writing – introduction and experimental sections. Meet in CSL-222 for lecture | Project #7 |
| Apr 24 | Project #7<br>**Project #6 report due** | Project #7 |
| May 1 | Make-up day<br>Project #8 due *(Temperature dependence of keto-enol equilibrium)* | Make-up day<br>**Project #7 report due**<br>*Last day of classes* |
| May 8 | Project #8 due *(Temperature dependence of keto-enol equilibrium)* | All reports are due on May 11 |
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