Physical Chemistry Laboratory - Spring 2023

CHEM 417
Room CSL-222

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Text: "Physical Chemistry Laboratory Manual" is available in Canvas, free of charge.
Other texts, such as those used for Chem 410A, 410B, and 251 will also be useful as references on theory and introductory laboratory techniques.
Required Lab Notebook: You will need a lab notebook with bound pages, and it must remain in the lab at all times. The notebook can simply be a spiral notebook with page number written in the upper right hand corner. You can photograph the pages to use at home. We will also have a number of notebooks available for your use. If you prefer, you can buy a notebook with duplicate pages. Each notebook page must be dated and signed. Since the lab work will be done in a short time window, and there may not be time to write reports between lab experiments, you will need to take very good notes. If important information is missing, you may have to repeat the experiment!

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 (six major ones and a smaller one), an introductory pipetting exercise, and two error analysis/data analysis assignments.

In each of the seven experimental projects, you will work with one other classmate, who is chosen randomly by the instructors. During the course of the semester, you will have the opportunity to work with seven different classmates. The reason for the random selection is so that you learn to work with peers from varied backgrounds, a skill that is important when working in academic or industrial labs.

The points for each of the six major projects are divided as follows:

Prelab: **5 pts** At the beginning of class on the first day of the project, the instructors will have you either a) take a pre-lab quiz based on the experiment that you'll perform or b) write a paragraph in your notebook summarizing the project that you'll do (without notes). Three examples of prelab quiz questions are: 1) explain how to prepare a solution that you'll use in the experiment; 2) sketch the experimental setup; and 3) explain how a physically important quantity is determined from the measured data. If the instructors instead have you write the summary, you should include the purpose of the experiment, the measurements to be made, and the major equipment to be used.

Notebook/lab work: **30 pts** Requirements and expectations for your lab notebook and lab work are given at the beginning of the lab manual. Some points will be given for the quality of the results.

Report: **65 pts** The lab reports must be typed and turned in at the beginning of class, one week after the last day of the project (see schedule at the end of this syllabus). 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. For the six major experiments, you should include the following sections in the reports: introduction, experimental, results, and discussion (For the smaller experiment, you'll include only the results and discussion sections). The introduction and experimental parts should be brief, with a 150-word limit for each. The written part of the results section should <u>not</u> include tables and graphs – these will be put at the end of the report, in order, as an appendix, and referred to in the results and discussion sections. The report will be returned if this format is not used. All of the text in the report should be constructed of well-formed sentences and paragraphs. Part of your grades will be based on the quality of writing. The points for the report are divided as follows:

10 pts Introduction/Experimental
45 pts Results
10 pts Discussion

Further details about how to write the reports will be discussed in class and are also contained in the manual.

Thus, for each of the six major projects, the total possible number of points is 100 points. The smaller project will be worth 50 points, 25 of which are for the notebook and lab work and 25 points for the report, which will contain only results and discussion sections. The introductory pipetting exercise will be worth 15 points, allotted to your lab work, documentation in your notebook of what you did, and data analysis. The take-home error analysis/data analysis assignment will count for 20 points, and the in-class error analysis/data analysis assignment will count for 15 points.

<u>Here is a summary of the points distribution:</u>

6 major experiments x 100	=	600 points
Smaller experiment	=	50 points
Intro pipetting exercise	=	15 points
Take-home assignment	=	20 points
In-class assignment	=	15 points
Total	=	700 points

***<u>You must write your own reports</u>*, and we expect all of the figures and tables to be done by the person writing the report. Therefore, do not send figures or tables to anyone else, including your partner; although the data might be the same, the figures should be your own creation. Also, do not let other people see your report, because it may be too tempting for them to use your ideas. If two reports are too similar to each other, then both will lose points.**

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

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. Although you will lose these points, you will be able to use your partner's data from any missed days in your report.

Although you are not required to come to lab after the experimental work is complete, we strongly recommend that you attend every day for the entire lab period. The analysis is time consuming and sometimes difficult, and it is useful to be able to ask questions while you are doing it. We will only have time outside of class for additional help if you have made full use of the time in class.

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. These points cannot be made up.

Grading scheme
The grading scheme for the course will be as follows:

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 = 7(100) + 25 = 725

List of Projects
Major projects:
- Kinetics of Bimolecular Quenching of $Ru(bipy)_3^{2+}$ by Oxygen
- Determination of the Critical Micelle Concentration via Fluorescence Spectroscopy
- Solution Properties Determined by Surface Tension Measurements
- Prediction and Measurement of Infrared and Raman Spectra
- Kinetics of the Oxidation of Erythrosin B by Sodium Hypochlorite
- Determination of the Diffusion Constant of an Ionic Compound

Smaller project
- Measurement of the Speed of Sound and Heat Capacity Ratio in Air

LEARNING OUTCOMES
At the end of this course, we expect that you will be able to
- Write clear and concise reports, including the preparation of tables and graphs
- Record results and observations in a notebook in a complete and clear manner
- Clearly present numerical results and their uncertainties
- Develop a working knowledge of a various types of spectrometers used in modern chemical research (e.g., IR, Raman, steady state and time-resolved fluorescence, UV-Visible)
- Be able to analyze raw data to determine specific properties of compounds and molecules
- Build or hone your ability to work with peers having diverse backgrounds

***Add/Drop Procedure**: The add/drop deadline is January 31, 2023. For details, see http://arweb.sdsu.edu/es/registrar/schedule_adjustment.html*

***Accommodations:** If you are a student with a disability and are in need of accommodations for this class, please contact Student Ability Success Center at (619) 594-6473 as soon as possible. Please know accommodations are not retroactive, and we cannot provide accommodations based upon disability until we have received an accommodation letter from Student Ability Success Center.*

***Religious observances**: Notify the instructor of planned absences for religious observances by the end of the second week of classes.*

***Academic Honesty**: The University adheres to a strict policy prohibiting cheating and plagiarism. Examples of academic dishonesty include but are not limited to:*

- *copying, in part or in whole, from another's test or other examination;*
- *obtaining copies of a test, an examination, or other course material without the permission of the instructor;*
- *collaborating with another or others in work to be presented without the permission of the instructor;*
- *falsifying records, laboratory work, or other course data;*
- *submitting work previously presented in another course, if contrary to the rules of the course;*
- *altering or interfering with grading procedures;*
- *assisting another student in any of the above;*
- *using sources verbatim or paraphrasing without giving proper attribution (this can include phrases, sentences, paragraphs and/or pages of work);*
- *copying and pasting work from an online or offline source directly and calling it your own;*
- *using information you find from an online or offline source without giving the author credit;*
- *replacing words or phrases from another source and inserting your own words or phrases.*

The California State University system requires instructors to report all instances of academic misconduct to the Center for Student Rights and Responsibilities..

***Resources for students**: A complete list of all academic support services--including the Writing Center and Math Learning Center--is available on the Student Affairs' Academic Success website. Counseling and Psychological Services (619-594-5220) offers confidential counseling services by licensed therapists; you can Live Chat with a counselor at http://go.sdsu.edu/student_affairs/cps/therapist-consultation.aspx between 4:00pm and 10:00pm, or call San Diego Access and Crisis 24-hour Hotline at (888) 724-7240.*

***Classroom Conduct Standards**: SDSU students are expected to abide by the terms of the Student Conduct Code in classrooms and other instructional settings. Prohibited conduct includes:*

- *Willful, material and substantial disruption or obstruction of a University-related activity, or any on-campus activity.*
- *Participating in an activity that substantially and materially disrupts the normal operations of the University, or infringes on the rights of members of the University community.*
- *Unauthorized recording, dissemination, or publication (including on websites or social media) of lectures or other course materials.*
- *Conduct that threatens or endangers the health or safety of any person within or related to the University community, including*
    1. *physical abuse, threats, intimidation, or harassment.*
    2. *sexual misconduct.*

Violation of these standards will result in referral to appropriate campus authorities.

***Medical-related absences**: Contact the instructor in the event they need to miss class, etc. due to an illness, injury or emergency. We will try to accommodate valid reasons for absence.*

***SDSU Economic Crisis Response Team**: If you or a friend are experiencing food or housing insecurity, or any unforeseen financial crisis, visit sdsu.edu/ecrt, email ecrt@sdsu.edu, or walk-in to Well-being & Health Promotion on the 3rd floor of Calpulli Center.*

Course Schedule **Spring 2023**

Starting Jan. 31 (when the major experiments begin), the semester will be divided into eight sessions, or rotations, each of which is three days long. You'll carry out the six major experiments during six of these rotations--- i.e., you will *not* have to attend two sessions, although you're welcome to come to class to ask questions about lab reports that you may be writing. The schedule of which rotations you must attend will be posted on Canvas. Note that if you have an off-week, you should either 1) hand in your report from the previous experiment by the start of class on the day the report is due, or 2) email your report to Dr. Pullman by the start of class and then give him a printed version of the report later that day.

Week of:	Tuesday	Thursday
Jan 17,19	No class	Introduction First day of class
Jan 24,26	Introductory project	Speed of Sound (SOS) experiment
Jan 31, Feb 2	Rotation #1 *Last day to add/drop*	Rotation #1 **SOS Report due 2/2**
Feb 7,9	Rotation #1	Writing reports; construction of tables and figures.
Feb 14,16	Rotation #2 *Rotation #1 report due*	Rotation #2
Feb 21,23	Rotation #2	Rotation #3
Feb 28, Mar 2	Rotation #3 *Rotation #2 report due*	Rotation #3
Mar 7,9	Rotation #4	Rotation #4 *Rotation #3 report due*
Mar 14,16	Rotation #4	Rotation #5
Mar 21,23	Rotation #5 *Rotation #4 report due*	Rotation #5
Mar 27–31	SPRING BREAK	SPRING BREAK
Apr 4,6	Rotation #6	Rotation #6 *Rotation #5 report due*
Apr 11,13	Rotation #6	Rotation #7
Apr 18,20	Rotation #7 *Rotation #6 report due*	Rotation #7
Apr 25,27	Rotation #8	Rotation #8 *Rotation #7 report due*
May 2,4	Rotation #8	*Last day of classes, May 4* **No reports accepted after May 4 (except from Rotation 8)**
May 9,11	Finals week	Finals week *Rotation #8 report due Friday 5/12*