

Physical Chemistry Laboratory - Spring 2022

Section 01: TTh 9:00-11:40

Section 02: TTh 2:00-4:40

Location: Room CSL-222

The first 5 lab sessions, Jan 20 - Feb 3, will take place over Zoom. The meeting ID is 88133125572. Use this link: <https://SDSU.zoom.us/j/88133125572>. Be sure to attend the first day of class for an important introduction, and an explanation of the first assignment.

Instructors:

Dr. Karen Peterson; CSL-309, kpeterson@sdsu.edu

Dr. David Pullman; CSL-301, dpullman@sdsu.edu

Text

“Physical Chemistry Laboratory Manual”; this year, the entire manual will be found in Canvas, Module 1. Download the parts as you need them, because they may be updated throughout the semester. 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 bound pages, and it will 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. 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.

Required Attendance

Attendance is mandatory: You must be on time for both the Zoom sessions and the in-class lab experiments. Points will be deducted if you are late. Points will also be deducted for unexcused absences - to avoid a penalty contact Dr. Pullman or Dr. Peterson before the start of class, and a make-up time will be arranged.

PROJECTS

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 six projects that require full reports, and a number of smaller projects. A summary of the projects is given here.

Handouts 1. Introduction and uncertainty assignment

Read the introduction in the manual carefully. The requirements for the notebook and the reports are detailed.

Also read Appendix F in the manual about error analysis

Assignment covering the introduction and uncertainties: **Due Thursday Jan 27, 2022 10 points**

Handout 2. Measuring the gravitational acceleration value **Due Tuesday Feb 1, 2022 25 points**

This is a short project that can be done at home. It requires only a smart phone and a sheet of paper. The report should be 1-2 pages.

Handout 3. Pipetting Exercise **15 points**

This is a practice exercise for using pipets that will be conducted in CSL-222; a schedule will be set up for use of the balances. No report will be done, but the notebook will be graded.

Handouts 4. NMR worksheet – analyzing NMR spectra **10 points**

The session will be conducted by Dr. David Onofrei by zoom, using computers in GMCS-245 that you'll access remotely. He will show you how to analyze spectra.

Handouts 5. Prediction and Measurement of Infrared and Raman Spectra

Gaussian calculations of oxalate anion **20 points**

This session will be conducted in GMCS-245. The results of the calculations will be presented in a partial report, which must be handed in before the

Experimental part of the project can be started.
Experimental project and report. **80 points.**

Handout 6. Fluorescence spectroscopy **100 points**

Handout 7. Surface tension **100 points**

Handout 8. Measurement of Diffusion **100 points**

Handout 9. NMR Determination of Keto-Enol Equilibrium Constants **100 points**

Handout 10. Speed of Sound **100 points**

This major project will be done by everyone within the same week.

Handout 11. Silver Nanoparticle Synthesis and Spectra **50 points**

Reports

Some of the smaller projects require short reports. Handouts 5 – 10 describe projects that require a full report. Part of the grade consists of the prelab assignment and the laboratory notebook. The points are distributed as follows:

Prelab (5 pts): At the beginning of class on the first day of the project, you will write a paragraph in your notebook summarizing the project you will be doing (without notes); include the purpose, the measurements to be made, and the major equipment to be used. Also, a question regarding sample preparation will be given (for example, you may be asked to calculate the amount of compound required to prepare a solution).

Be sure to watch the relevant videos and read the project handout carefully. If you are not prepared, you might not be able to finish the lab, or you may do the experiments incorrectly. That would be unfortunate.

Notebook/lab work (30 pts): Details about the notebook expectations are given in the introductory handout

Report (70 pts): The lab reports must be typed and sent to the instructor on the day they are due. Due dates will be given as the semester progresses. The reports will contain these sections: introduction, experimental, results and discussion. The introduction should be brief, with a 150-word limit for each. The written part of the results section should not 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. The manual contains more details about how to write the report.

1 point for each day late will be subtracted for reports submitted after the deadline.

Deadlines will be posted as the semester progresses.

You must write your own reports, 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; if they are copied, both the sender and sendee will be penalized. This policy includes penalties for uploading or downloading your reports to websites such as Chegg. 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. **The data used in the report must match the data in your notebook and excel files.**

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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 = 710

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 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 February 1, 2022 at 7:59 PM. 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 (tentative – may be updated as the semester progresses)

Week of: (Monday date)	Tuesday	Thursday
Jan 17	No class	Zoom: Introduction First day of class Assign “Gravity” project
Jan 24	Zoom: Reports/Estimating errors/error analysis. Gravity project - discussion	Zoom: Reports/Estimating errors/error analysis. Gravity project - discussion

Jan 31	Zoom: NMR workshop;	Zoom: Gaussian Project introduction;
Feb 7	Pipetting exercise/ Speed of sound project In CSL-222	Pipetting exercise/ Speed of sound project In CSL-222
Feb 14	Start of projects In CSL-222	
Feb 21		
Feb 28		
Mar 7		
Mar 14		
Mar 21		
Mar 28		
Apr 4		
Apr 11		
Apr 18	Make-up days	
Apr 25		

May 2		<i>Last day of classes, May 6</i> Reports not accepted after May 13
May 9		