

CHEM 332L PHYSICAL CHEMICAL MEASUREMENTS
Spring 2016

Instructor: Prof. Susumu Takahashi
LJS 152 (213) 821-3187
susumuta@usc.edu
Office Hours: Thursday 10-11 am or on appointment

Course Goal: The laboratory course complements the Physical Chemistry lecture series. The lab introduces key skills in instrumentation, signal detection, data collection and analysis as well as illustrating core physical chemistry concepts. In particular, the lab serves to support objectives 4 and 5 (Application and Analysis, Evaluation and Judgment) from learning outcomes defined for chemistry department majors. http://chem.usc.edu/undergraduate/learning_outcomes.html

Lectures: Lecture and discussion will be on Tuesday at 9:00a.m. Topics covered will include data and error analysis, report writing, electrical, optical, and vacuum systems, computer use, statistical tests of data, and specific instruments. The individual experiments will not always be discussed in detail, though specific methods involved in them will be.

Text: You will be given a laboratory manual at the first class meeting: the lab manual contains detailed material on each of the experiments available in the 332L laboratory as well as reference lists to provide additional information related to the experimental works.

It will be useful for you to refer to *Experiments in Physical Chemistry* by Shoemaker, Garland and Nibler (or a similar text). A few copies of Shoemaker are available in the lab.

Course Outline: The course consists of lectures, discussions, laboratory work and presentations. The lectures will cover both theoretical material and techniques related to the laboratory experiments based on the first of the texts given to you.

| | |
|---------------|-----|
| Lab reports | 70% |
| Presentations | 30% |

Each student is to complete six (6) of the experiments listed below, two experiments from each of the groups I, II and III. There will also be a preliminary experiment on signal measurements with an oscilloscope. Due dates for experimental reports will be posted.

During the lectures, students will give an oral presentation (~20 min.) about the experiment which he/she will perform (or currently performing). Any appropriate professional type of presentation is acceptable; blackboard presentation, overhead projection, and PowerPoint have been used in the past.

Laboratory: Though the laboratory is formally scheduled in three segments, it will be open without breaks during the day. You will plan your work so you may use this time to your advantage. The laboratory will close promptly at **6:00 p.m.**, and may close earlier if no students are working; you must arrange your work with this in mind, and must keep the instructor informed if you leave the laboratory and plan to come back later in the day.

Experiment List:

I. Spectroscopic Experiments:

1. Electronic spectrum/dissociation energy of Iodine
2. Excited state properties of 2-naphthol
3. Spectrofluorimetry and fluorescence quenching
4. Infrared spectrum of HCl/DCI

II. Solution chemistry:

5. Conductance of electrolytes (KCl, HCl, KAc, HAc)
6. Magnetic susceptibility of transition metal ions
7. EMF (Pt/Hydrogen//AgCl/Ag)

III. Chemical Kinetics:

8. Pulsed NMR kinetics
9. Monte Carlo Simulation of a Lennard-Jones Fluid
10. Pulsed laser fluorescence and quenching
11. Physical adsorption of gases

Computers: Computers are available in the lab for data processing and for direct data acquisition on a few experiments. Computer use is a part of the course. It will be assumed that students are able to use a spreadsheet program for data processing. OriginLab *Origin*, a particular useful program for data processing and plotting, is installed on each of the computers and will be briefly introduced. Certain programs will be available for use on students' computers.

Notebooks: Each student must have a *bound* duplicate-style laboratory notebook. All raw data (balance readings, volumes, meter readings, control settings, etc.) must be entered directly in ink in the notebook. It should be possible to find every bit of information needed to obtain final results from the entries in the notebook; nothing should be 'from memory'. The notebook should have duplicate pages which are to be turned in to the TA at the end of each laboratory period.

Reports: Your lab report should be submitted as a Word document or PDF by email to Prof. Takahashi, susumuta@usc.edu.

Assignments & Information: All information including assignments as well as changes to the schedule will be announced via email. It is your responsibility to check frequently.

Academic Integrity: USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. *SCampus*, the Student Guidebook, contains the Student Conduct Code in Section 11.00, while the recommended sanctions are located in Appendix A: <http://www.usc.edu/scampus/>. Students will be referred to the Office of Student Judicial Affairs and Community Standards for further review, should there be any suspicion of academic dishonesty. The review process can be found at: <http://www.usc.edu/student-affairs/SJACS/>.