DRAFT SYLLABUS
Ch 6 - PHYSICAL CHEMISTRY LABORATORY
Remote
Spring Quarter 2021

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Course Web Site: **Canvas**

ON-LINE APPS: Zoom, Teamviewer
FILE-SHARING: Canvas
ELECTRONIC LAB NOTEBOOK: Labarchives.com

Content:

This course will introduce you to experiments in physical and biophysical chemistry. Topics:

1. Computational Chemistry
2. Statistical Data Analysis
3. At home:
   Introduction to electronics and data acquisition (oscilloscopes)
   Laser spectroscopy, polarimetry and kinetics
4. Remote:
   Live-streamed experiments with remote desktop control of instrumentation (e.g. possible experiments include EPR, Raman spectroscopy, mass spectrometry, NMR)

You will work in pairs on the lab experiments.

Prerequisites

Quantum mechanics (Ch21a, Ph2b, Ph12b, or related)
Spectroscopy Ch21b
Statistical thermodynamics (Ch21c, Ph2c, Phy12c – can be taken concurrently)

Requirements:
Lab notebooks turned in on FRIDAY, one week after lab completion.
Electronic lab notebook: Labarchives.com

Introduction to the Physical Chemistry Laboratory

The principal objectives of the Physical Chemistry Laboratory are to acquaint the students with a variety of phenomena that are the contents of this subject, to familiarize them with a number of the techniques in use, to develop a facility in the making and interpretation of measurements, and to give them some basis for judging the reliability of data. Both lecture and laboratory courses in physical chemistry are in the process of constant change, with considerable emphasis on the material necessary to enter rapidly into those fields that are most alive and developing.

The course will familiarize the participants of the class with several techniques useful in research even for those whose interests are primarily in organic, inorganic or biological chemistry, and should help develop the skill in making and interpreting measurements. But particularly, it should help cultivate an appreciation for the meaning of measurements, a healthy skepticism as to their reliability, and an open mind regarding the possibility of hidden sources of error.

Chemists in all fields increasingly are using physical methods, often with commercial instruments of a high degree of complexity that they cannot expect to understand in full detail. It is necessary to develop a healthy attitude towards these "black boxes". In general, one should not be afraid to attempt the repair of even modification of commercial instrumentation in the interest of making progress toward the solution of research problems. A little common sense and well-developed power of observation can carry one quite far with even the most complicated instrument, In the physical chemistry laboratory students will be conducting experiments with both commercial and "home-made" equipment. They are encouraged to make simple repairs on equipment when they are called for.

The present wealth of research equipment available to scientists offers tremendous possibilities for the rapid accumulation of knowledge. It may have some tendency to discourage the independence, resourcefulness, and manipulative skills necessary in a really outstanding experimentalist. It would be unfortunate indeed if the progress of science were dictated by the limitations of equipment with which instrument makers see fit to provide us. The existence of a commercial instrument in general indicates that a corresponding technique is already well established. A new field may well require a revolutionary approach (scanning probe microscopy is a good example). Some students may elect to participate in the development of new apparatus and experiments to be incorporated into the physical chemistry laboratory course in the future. Students should feel free to offer suggestions for new experiments.

A final but important objective of this course is to develop the habit of keeping the kind of laboratory record one will later find important in any research activity.

Grading

You will be graded on your "performance" in the laboratory, and your analysis and interpretation of experimental data present in the laboratory notebook. There will be no examinations administered in this course.

50% Experimental analysis (in notebooks): including analysis of results (figures, tables, error analysis, and comparison with literature values or theoretical models where appropriate), conclusions (with discussions where appropriate), and any questions to be answered in the laboratory notes.

30% Laboratory Notebook: The notebook will be graded on in-session note-taking, thoroughness, organization, and orderliness (not necessarily related to neatness).

10% TA evaluation of preparedness and effectiveness in the laboratory. It is essential that you read the material handed out for each experiment before coming to the lab and be prepared to ask and answer questions regarding the experiment.

10% Prelab questions.

LATE PENALTY: 10% for notebooks turned in late. Request extensions from Instructor only.

COLLABORATION POLICY

Collaboration is encouraged. Lab partners can work together on all aspects of the lab including data plotting and analysis. Groups may also work together figuring out how to do the analysis, comparing answers to prelab/report questions, and discussing other issues that they may have.

However, some restrictions to the above policy are necessary:

1. Each student should submit a distinct report. This means that everything in the report should be in the student's own words; while students in groups may have similar answers or explanations, it should be apparent that each student understands what is going on and can explain it.

2. Each group should use its own data unless they have been given explicit permission by the TA or a Professor.

The equipment and experiments in Ch6 are often very sophisticated, but there is a price to complexity. Experiments don't always work as expected; this is the nature of science. In these cases, students may be given raw data (but not analysis) from past years, or even from another group in the same year. However, the notebook should explicitly identify such data and state what is wrong with their data and why their data may be bad.

3. Each group must perform their own full data analysis.

4. While members of a group may use the same plots, each student should be able to recreate all plots and explain any part of their report if asked to do so by the TA.