SYLLABUS
CHEM 358, Physical Chemistry Laboratory II
Fall 2013

Instructor Information

Instructor: Dr. Reinhard Schweitzer-Stenner
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Tel: (215) 895-2268
Email: rschweitzer-stenner@drexel.edu
Office hours: Monday, 3.00 – 5.00 p.m. These are my 'official' office hours. Students are welcome to email me to schedule a meeting outside of my office hours.

TA: Ms. Leah Pandiscia
Office: Disque 605
Tel: (215) 895-2654
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Office hours: Wednesday, 2:00 – 4:00PM. Students are welcome to email Ms. Pandiscia to schedule a meeting outside of her office hours.

Student Learning Information

A. Course Description and Calendar

Lecture (358A) (Monday, 2.00-2.50 p.m.)

The 1h lectures are linked to the experiment. Experiments, which are spread over two weeks will be introduced in a single lecture. The lectures will introduce the physical and chemical background of the experiments and will provide a short overview of the respective experimental protocols without going into details.

Lecture schedule

Week 1:	September 19	E1: Kinetics of Homogeneous Reactions in Solution.
Week 3:	October 3	E2: Adsorption of Acetic Acid on Charcoal
Week 5;	October 17	E3: Spectrophotometric Determination of pK of an Indicator I
Week 7:	October 31	E4: Excited State Properties of 2-Naphthol: Equilibrium
Week 8:	November 7:	E5: Excited State Properties of 2-Naphthol: Kinetics
Week 9:	November 15:	E6: Measurement of the Diffusion Coefficient in Solution

Experiments (Tuesday, 3.00 p.m. – 5.50 p.m, in Disque 409):

This laboratory consists of 6 experiments two of which spread over two weeks. Even though this is not an official writing intensive course the requirements for lab-reports are the same as those stipulated for CHEM 357. Students will be given the opportunity to submit a preliminary version of the lab-report for experiment E1 by October 4, which will be individually discussed either with the instructor or the TA on October 11. No experiment is scheduled for this week.

WEEK	DATE	EXPERIMENT
1	September 20	E1a: Kinetics of Homogeneous Reactions in Solution I (Exp. 21)
2	September 27	E1b: Kinetics of Homogeneous Reactions in Solution II (Exp. 21)
3	October 4	E2: Adsorption of Acetic Acid on Charcoal (Handout)
4	October 11	Discussion of laboratory reports for E1 with instructor and TA
5	October 18	E3a: Spectrophotometric Determination of pK of an Indicator I (Handout)
6	October 25	E3b: Spectrophotometric Determination of pK of an Indicator Parts II (Handout)
7	November 1	E4: Excited State Properties of 2-Naphthol: Equilibrium (Exp. 34)
8	November 8	E5: Excited State Properties of 2-Naphthol: Kinetics (Exp. 35)
9	November 15	E6: Measurement of the Diffusion Coefficient in Solution (Exp. 19)

Examinations (room to be announced)

10	November 29	10 minutes power point presentations of a selected experiment
12	**Final Examination During Finals Week**	

B. Purpose of course

The overall goal of this course is to link theoretical knowledge of specific physical chemistry topics to experimental experience. It is common knowledge that a thorough understanding of theoretical concepts requires 'learning by doing'. The physical chemistry topics dealt with in this course are thoroughly taught in Chem 253 and 359, specific aspects will be repeated in the accompanying lecture course.

C. Statement of expected learning

After completing this lab-course, the students should have learnt:

- To perform, analyze, and describe in writing quantitative physical measurements on chemical systems that illustrate the principles of physical chemistry.

- Core physical principles of absorption and fluorescence spectroscopy and
- Basic laws of chemical kinetics and the relationship between relaxation and chemical equilibrium.

Course Material

Most of the scheduled experiments are from Experimental Physical Chemistry, Second Edition, by Arthur M. Halpern (Prentice Hall, 1997). For all experiments, handouts will be provided to the students, which contain information about the theoretical background of the experiments and exact descriptions of the experimental protocol. Further information about the experiments' background can be inferred from classical physical chemistry textbooks (e.g. Atkins-de Paula), used for Chem 253 and 359.

Assessment of student performance

Lab reports. With the exception of the report for E1, lab reports have to be submitted to the TA within 7 days after completion of the experiment. A preliminary report for E1 has to be submitted by October 4 and will be discussed with students on Tuesday, October 11. If students do not submit this preliminary version on time, it will not be discussed on October 11 and the score for the respective final lab report will be reduced by 10 points. The final version of this lab report has to be submitted by Tuesday, October 18. Late submission of lab reports will also reduce the score by 5 points per day (weekend days are included). The average grade of the laboratory reports will count for 75% of the final grade. The student's grade is primarily based on the written reports, but points can be subtracted, if he/she is unprepared or does not practice safe and neat laboratory procedures. Some basic principles for writing the lab report should be taken into account. The introduction should contain information about the basic issue to be addressed by the experiment and the basic theory. If you write equations, use the equation editor of word. Define the parameters. The result section should contain sufficient text to guide the reader through the experimental data. Figure and table captions should be meaningful and self-explanatory. The structure of a lab report is listed in the following:

1. The title of the experiment, your name, etc.

2. Abstract.
This is a short paragraph that gives a summary of the experiment, including the final results (with uncertainties, if possible).

3. Introduction (or background)
This section (generally no more than two pages) describes the theory and concepts involved. Include primary equations used in the calculations.

4. Procedure
This should be a brief and general description of the experimental procedure, avoiding detailed descriptions of the operation of any instrumentation.

5. Data

Here the measurements and the raw data are presented. Use tables prepared with a spreadsheet. In general no calculations should be associated with the data.

6. Results

This section presents the results obtained using the raw data from the previous section, including any plots or figures produced (when making plots, label the axes and display the proper units). Once this part of the report is completed, you should know if you were able to accomplish the "Objective" of the experiment. For example, if the objective of the experiment is to measure the viscosity of a liquid at five different temperatures, you should have a table in the RESULTS section with values for viscosity at those five temperatures. An example of each type of calculation should be included in this section.

7. Error analysis

This section shows the accuracy and precision of the experimental results. The accuracy is represented by the relative error, which is obtained using the "true value" of the parameter of interest. The "true value" (or best accepted value) can usually be found in reference sources, such as the CRC Handbook of Chemistry and Physics. When reference data are cited, be sure to properly identify the source or sources of such data in the acknowledgements section.

In cases where repeated measurements are performed, the precision can be determined by obtaining the standard deviation and/or standard error. Sample calculations of any error analysis should be included in this section.

The error section should contain the error analysis, not an explanation of errors, which is part of the discussion.

8. Conclusions and Discussion

The experimental results and the respective errors are discussed in this section. The explanation of errors should be justified by quantitative estimations, not by speculations. This section should also include a discussion of sources of error and/or uncertainty. You must be specific here. "Human error" is not an acceptable source of error. The quality of the experiment is evaluated considering its success or failure. In case of failure, the student should attempt to identify the source of the problem. In general, the student(s) should discuss how the lab demonstrated the objectives of the lab, or how the data answered the questions posed at the start of the lab.

9. Acknowledgements

This section should include any reference materials used in the interpretation of data, the writing of the report, or the answering of questions. Persons contributing to this work also should be acknowledged in this section (e.g., other groups who provided data).

10. Questions.

At the end of each experiment, there are a few questions. Include the answers to the questions in your report.

The lab-reports assess

- the quality of the students' experimental performance in the lab
- the students' understanding of the underlying physics and chemistry
- the students' capability to use appropriate technical and scientific language
- the students' capability to perform simple data analyses
- general writing capabilities of students.

Oral presentation. Each student will have to present one experiment in the seminar session in week 10. The time for each power point or keynote presentation will be 10 minutes + 5 minutes for questions and discussions. The concrete experiment for the talk will be selected by the instructor. In this talk, the student should present background, experimental set up and strategy, results and a short discussion. The presentation will be graded and counts for 20% of the overall grade. The oral presentation assesses the capability of students to present scientific facts to an audience.

Final Exam (in Exam Week). The final exam is *optional*. Each student may use his/her grade on the final exam to replace the lowest lab grade. If the grade on the final is lower than the lowest lab grade, the final exam will not be counted towards the final course grade. This exam will be based on the theory and analysis associated with the labs.

Attendance. Attendance counts for 5% of your grade and will include punctuality, whether or not you brought your safety glasses and laboratory technique, among other things.

Grade scale. Final grades will be determined according to the following scale:
A+ 97-100, A 93-96, A- 90-92, B+ 87-89, B 83-86, B- 80-82, C+ 77-79, C 73-76, C- 70-72, D+ 67-69, D 63-66, D- 60-62, F: 0-59. Grade A will reflect an excellent, far above average, nearly flawless performance. Grade B reflects a very good/good performance with minor deficiencies. Grade C reflects an average performance with some significant deficiencies. Grade D reflects a partially deficient though still satisfactory performance. Grade F reflects an unacceptable, highly deficient performance

Academic policies

Attendance. Students are expected to attend the lecture and laboratory each week. Attendance will not be taken in the lecture class, but students will be responsible for obtaining any information presented during the lecture. Once the lecture has begun, I will expect to have your full attention. Make sure that your cell phone is turned off during class. If I catch you text-messaging during class, I reserve the right to ask you to leave.

Role of TA and instructor. It is the job of TA to assist students who are running into difficulties with their experiments and to advise them with respect to the writing of their lab report. It is not her job, to answer questions that are clearly addressedes in the syllabus and in the lab procedures.

Students can make up only for one of the laboratories they miss, regardless of the reason for the absence. A valid reason for missing the scheduled laboratory will not excuse the student from

performing the lab. A make up for a second lab will be approved only under exceptional circumstances.

Safety. Students are expected to practice proper and **SAFE** laboratory procedures as defined by University policies. No food or drinks are allowed in the labs. **A laboratory coat and eye protection must be worn at all times.** All students have to buy a laboratory coat. Students who do not comply with these rules, which will be enforced by the respective teaching assistant, will not be allowed to start or continue an experiment. If a student was prevented from completing an experiment due to his/her violation of safety rules, he/she will not receive any credit for this particular lab.

Preparedness: Students are obliged to prepare themselves for the laboratory by reading the laboratory procedures and attending the lecture. It is not the job of the teaching assistant to explain the entire experiment in a pre-lab session.

Cheating or dishonesty (which includes plagiarizing) will not be tolerated. Cheating or dishonesty may result in a ZERO, failure of the course, or dismissal, as appropriate.