CHEM 358, Physical Chemistry Laboratory II
Winter 2004

Course Objectives: To perform, analyze, and describe in writing quantitative physical measurements on chemical systems that illustrate the principles of physical chemistry. In this course, emphasis is placed on experiments in chemical kinetics, molecular spectroscopy, and transport properties.

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T 10-12
W 1-3

Textbook: Most of the scheduled experiments are from Experimental Physical Chemistry, Second Edition, by Arthur M. Halpern (Prentice Hall, 1997). The other experiments have been designed and developed by Drexel faculty and staff.

Lecture/Tutorial (Thursday, 1:30-2:20 PM, CAT 75): Each student will be expected to have read and prepared for the intended laboratory experiment prior to the lab lecture each week. The lab lecture will focus on the principles and theory involved in that week’s scheduled experiment and will include minimal detailed instructions concerning the experiment itself.

Grading: Lab reports (80%). The student’s grade is primarily based on the written reports.

Lab work/attendance (20%). This will be comprised of the student’s attendance and the instructor’s assessment of the quality of the work done in the lab. In order to get full credit, each student must be on time, practice safe and neat laboratory procedures, and be prepared for the lab, i.e., have read and understood the procedure before coming to lab.

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.

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.
Safety: Students are expected to practice proper and **SAFE** laboratory procedures. No food or drinks are allowed in the labs. Eye protection must be worn at all times.

Experiments (in Disque 404):

There will be **no labs** on Tuesday, 1/6 or Thursday, 1/8.

<table>
<thead>
<tr>
<th>WEEK</th>
<th>DATE</th>
<th>EXPERIMENT</th>
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<tbody>
<tr>
<td>1</td>
<td>Jan. 6, Jan. 8</td>
<td>No lab this week; first Kinetics lecture</td>
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<tr>
<td>2</td>
<td>Jan. 13, Jan. 15</td>
<td>Kinetics of a Homogeneous Rxn in Solution, Part I (Exp. 21)</td>
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<tr>
<td>3</td>
<td>Jan. 20, Jan. 22</td>
<td>Kinetics of a Homogeneous Rxn in Solution, Part II (Exp. 21)</td>
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<td>4</td>
<td>Jan. 27, Jan. 29</td>
<td>Surface Tension Properties of Liquids (Exp. 16)</td>
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<tr>
<td>5</td>
<td>Feb. 3, Feb. 5</td>
<td>Spectrophotometric Determination of pK of an Indicator, Parts I and II (Handout)</td>
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<td>6</td>
<td>Feb. 10, Feb. 12</td>
<td>Spectrophotometric Determination of pK of an Indicator, Part III (Handout)</td>
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<td>7</td>
<td>Feb. 17, Feb. 19</td>
<td>Excited State Properties of 2-Naphthol, Part I (Exp. 34)</td>
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<td>8</td>
<td>Feb. 24, Feb. 26</td>
<td>Excited State Properties of 2-Naphthol, Part II (Exp. 35)</td>
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<tr>
<td>9</td>
<td>Mar. 2, Mar. 4</td>
<td>Adsorption of Acetic Acid on Charcoal (Handout)</td>
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<td>10</td>
<td>Mar. 9, Mar. 11</td>
<td>Measurement of the Diffusion Coefficient in Soln (Exp. 19)</td>
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**Final Examination During Finals Week**

**Lab Reports:** Reports are to be handed in to your lab instructor **1 week** (by 5 pm) after the date of completion of the experiment. Points will be deducted for late reports (**5 points per day**). No reports will be accepted after the Friday of finals week.

Students will be working in groups of two or three. **However, each student is required to submit their own report for each experiment.**

Reports should follow a standard format. Each report must consist of 10 sections:

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 one page) describes the theory and concepts involved, including the primary equations used.

4. Procedure.
This should be a brief and general description of the experimental procedure, avoiding detailed descriptions of the operation of any instrumentation. This should be in past tense (i.e., what you did) and should not be instructions for someone else to perform the experiment.

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 the CRC Handbook of Chemistry and Physics, or in appropriate alternative reference sources. 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 is determined by obtaining the standard deviation and/or standard error. Sample calculations of any error analysis should be included here.

This section should also include a discussion of sources of error and/or uncertainty. You must be specific here. "Human or experimental error" are not acceptable sources of error.

8: Conclusions and Discussion.
The experimental results are summarized and discussed in this section. 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., your lab partner, other groups who provided data, etc.).

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

There are sample reports available from previous terms. You may look at them to get an idea of what is expected.