

CHEMISTRY 334 AND 344: PHYSICAL CHEMISTRY LABORATORY Term II, 2004-2005

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Office Hours: 3-5 pm Monday, or by appointment

Laboratory Hours:

2-5 pm T (CHN 334) Room C101 1 credit
2-5 pm T and Th (CHM344, but see below) Room C101 2 credits

Text: Garland, C.W.; Nibler, J.W.; Shoemaker, D.P. *Experiments in Physical Chemistry*; McGraw Hill; New York, NY, 2003; 7th Edition, and handouts.

Prerequisite: CHM228 and CHM333 (for CHM334), CHM230 and CHM343 for (CHM344).

Corequisite: CHM342 (for CHM334 and CHM344).

Objectives: The objectives of this laboratory are:

- To illustrate established principles in Physical Chemistry.
- To provide a clear understanding of the instrumentation, experimental procedure, and data analysis.
- To acquire experience in Report Writing.
- To search the literature and follow the historical development of the science of Physical Chemistry.

Laboratory Schedule: The laboratory experiments supplement, and are correlated with, lecture material in Physical Chemistry. We will attempt to schedule each experiment after the material has been introduced in the lecture; from our experience, however, we know that this is not always possible. The experiments selected belong to the following subjects:

1. Chemical Equilibrium in Solution #12
2. Binary Liquid-Vapor Phase Diagram #14
3. Macromolecules #28
4. UV Spectroscopy #34
5. Pyrene as a Fluorescent Polarity Probe (Handout)
6. Determination of the Critical Micelle Concentration (CMC) based on Pyrene as a Fluorescent Polarity Probe (Handout)
7. ESR Spectra of Nitroxide Radicals and Spectra Simulation (Lecture and Handout)

In addition, each student (in both CHM334 and CHM344) will make a 15-minute Class Presentation at the end of the Term. The topic selected for this term is **Major Personalities in Physical Chemistry or Molecular Spectroscopy**. These personalities will be selected in consultation with the Instructor. The *tentative* date for the Class Presentations is 22 March 2005. Students are expected to document the literature search process in the Lab Book, and describe it in the Class Presentation (in lieu of report). **The lecture is considered as one lab experiment.**

Students are expected to come on time to all sessions. Attendance will be taken 10 minutes after the hour. Punctuality, or the lack of, will be reflected in the final grade.

Students must study and understand the experiment thoroughly before coming to the lab. Each student **MUST** have a detailed record of the experiment in the notebook. Data and calculations at the end of each experiment will be examined and signed by the TA after the preliminary calculations have indicated that the experiment was properly carried out, and the results are reasonable.

Additional Reading: Chapter I in Text **before** your first experiment, and Chapter II in Text **before** your first report.

The notebook must be hard-covered and the pages numbered. **Students will be allowed to perform their experiments only if they brought the notebook to the lab.**

Students must wear goggles in the lab at all times.

Course Requirements:

3 experiments or equivalent (CHM334)

6 experiments or equivalent (CHM344)

Students will be assigned experiments from different categories. Experiments will be performed individually or by 2 students, as determined by the TA. Notebooks will be collected by the TA at the end of the term.

Experiments for CHM334:

- #12, 14, or 28
- UV Spectroscopy (#34)
- Pyrene as a Fluorescent Polarity Probe
- Presentation

Experiments for CHM344:

- UV Spectroscopy (#34) (one experiment)
- #12, 14, or 28 (one experiment)
- Determination of the Critical Micelle Concentration (CMC) based on Pyrene as a Fluorescent Polarity Probe (two experiments)
- ESR Spectroscopy (two experiments)
- Presentation (1)

Students in CHM344 are expected to perform 3 of the 6 required experiments during the Tuesday lab, and to prepare a Class Presentation. For the two additional experiments needed, the students will perform one of two mini-research projects: 1. **ESR Spectra of Nitroxide Radicals – Experiment and Simulation**, and 2. **Determination of**

the Critical Micelle Concentration (CMC). The first step in part 1 is and understanding of the spectrometer, preparing the samples, and collecting the spectra; the second step is the simulation of the spectra. More details will follow. Work on this subject can be performed in a flexible way, under the supervision of the Instructor and/or TA. In part 2 you will use pyrene as a polarity probe for the detection of micelle formation in aqueous surfactants solutions as the concentration of the surfactant increases.

FULL LAB REPORT MUST BE SUBMITTED NOT LATER THAN AT 5 PM ON FRIDAY OF THE WEEK FOLLOWING THE COMPLETION OF THE EXPERIMENT. THE REPORTS MUST BE TYPED USING A TEXT EDITOR, AND THE GRAPHS MUST BE PREPARED BY GRAPHIC SOFTWARE.

Students who are late with their report will receive no credit.

Course Grade for CHM334:

2 completed experiments	30pts
2 completed reports	30pts
Library Search and Presentation	30pts
Experimental technique and attendance (assessed by TA)	10pts
Total	100pts

Course Grade for CHM344:

3 completed experiments	45pts
3 completed reports	45pts
Library Search and Presentation	30pts
Mini-research Experiment	60pts
Experimental technique and attendance (assessed by TA)	20pts
Total	200pts

Grading:

A: 100-95%	A-: 94-90%	
B+: 89-85%	B: 84-80%	B-: 79-75%
C+: 74-71%	C: 70-65%	C-: 64-61%
D: 60-50%	F: below 50%	

Extra Credit: Points (maximum of 1 pt per lecture) will be given to students who submit a one-page typed report of the Seminar Lecture. Please include in your report the main topics discussed, how you benefited (or not!) from the lecture, and any comments and suggestions for improving the lecture and the Lecture Series in general. **The report must be submitted on the Tuesday following the lecture.** Late reports carry no credit. The Seminar Lecture Program for Term II will be posted outside the Chemistry office.

January 2005

University of Detroit Mercy
Department of Chemistry and Biochemistry
CHM 334/344

Instructor: S. Schlick, 102 Chemistry

Physical Chemistry Lab Reports

The main parts of the Report are:

I. INTRODUCTION

Objectives
Methods

II. EXPERIMENTAL SECTION

(Illustrate apparatus, give references)

III. RESULTS

Give sample calculation
Summarize results in Tables and Graphs

IV. DISCUSSION

Assess sources of error and suggest improvements
Compare your results with literature

V. COPY OF RESULTS IN YOUR LAB BOOK

(You must have the TA's signature)

VI. REFERENCES

(In ACS style, Jane has the ACS manual)

General Requirements: The report must be typed using a text editor, paginated and stapled, and submitted on time. Graphs must be drawn by computer.

January 2005

**University of Detroit Mercy
Department of Chemistry and Biochemistry
CHM334/344**

Instructor: S. Schlick, 102 Chemistry

**Physical Chemistry Lecture:
Library Search for a Major Personality in Physical Chemistry
or Molecular Spectroscopy**

The main parts of the Presentation are:

I. INTRODUCTION

Objective (here describe why you searched it)
Methods (here describe the search process, name the sources you read,
give references)

II. SELECTION PROCESS

List several personalities
Describe why you have made your selection

III. YOUR CHOSEN PERSONALITY

Describe his/her education, professional data, type of spectroscopy

IV. DISCUSSION

List major accomplishments and breakthroughs

V. REFERENCES

(In ACS style, Jane has the ACS manual)

The duration of each presentation is ≈ 15 min, including time for questions. Tentative date of the presentations is 22 March 2005. See Instructor for the exact duration of the lecture and the presentation date. You should start with the Cover Slide, followed by a slide that describes the Plan of Lecture. Number your slides.

A hardcopy of your presentation should be submitted to the Instructor and to the TA on the day of the presentation.