

Physical Chemistry Laboratory
CHEM-UA 661
Tentative Syllabus, Fall 2017

General Information

Laboratory location and hours

M 2:00 PM - 5:30 PM 455 Brown
T 12:30 PM - 4:00 PM

Lecture location and hours

F 9:30 AM - 10:45 AM 508 Silver

Instructor

Prof. Dubravko Sabo
1001W Silver, 212-998-8799
dubravko.sabo@nyu.edu
Office Hours: Wed 3:30 PM - 5:00 PM

Laboratory Instructor:

Zhuoran Long	1166 Waverly	zl1277@nyu.edu
Jianing Lu	1166 Waverly	jl7003@nyu.edu

Text

Henry C. Brenner, Panče Naumov, Dubravko Sabo, Jamie Whelan, Ahmad Husain, Naba K. Nath, Elisa Nauha, Manas K. Panda, Subash C. Sahoo, *Laboratory Manual of Physical Chemistry*, Published by New York University.

Laboratory Notebook

You will need a laboratory notebook in which to record your data and experimental observations. You may use a bound composition book for this purpose, and submit photocopies of the relevant notebook pages with your laboratory reports.

Lecture Information

Lectures will be given every Friday. Some special dates to note:

Sep. 8	First lecture
Oct. 9	Fall Recess
Dec. 8	Last lecture

Exams

The Final Examination is on Monday, December 18, 4:00 - 5:50 PM, Room TBA.

Grading

The course grade will be determined by the following weighting:

Laboratory Reports	50%
Oral Presentation	20%
Instructor Evaluations	10%
Final Exam	20%

Written lab reports are due in the lab period two weeks after the experiment is done.¹ The lab report grade will be multiplied by a factor of 0.95 for each day that a report is late. You are expected to prepare for each lab by reading the experiment or handout in advance.

Course and Laboratory Rules

Laboratory check-in is the week of Sep 11. At the check-out, you will be charged for any broken or lost items in your locker, which will be charged to your Campus Cash account.

You are required to perform the experiments during the assigned laboratory period. Careful planning and execution will be necessary to complete the work in one period.

Always prepare thoroughly for each experiment *before* the laboratory period. Carry out all calculations that can be carried out in advance before you come to the laboratory.

Some experiment involve theoretical and/or experimental principles and techniques that will be unfamiliar and that will require considerable study. Work out difficult points and obtain advice from the laboratory instructional staff in advance.

General Laboratory Policies

1. Observe all safety regulations.
2. Keep all equipment and working areas in the laboratory clean.
3. When in doubt about how to use a piece of equipment or apparatus, *consult an instructor first*.

¹In the event that the lecture pertaining to the experiment has not been given by the date the report is due, the written report will be due in the next regularly scheduled lab period following that lecture.

Laboratory Notebooks

All data and other primary information on an experiment must be recorded directly in your laboratory notebook. Your notebook must be initialized by the instructor during the laboratory period. Copies of the relevant laboratory notebook pages *must* be turned in, along with any chart recordings, spectra, etc., with your laboratory report.

DO NOT USE LOOSE SHEETS OF PAPER FOR ANY DATA TAKEN IN THE LABORATORY.

Be certain your name, the name of your partner, the date the data was taken, and the (short) title of each experiment are written on each page. Write subtitles for each part of the experiment. Clearly indicate with titles, headings, comments, etc., what the data refer to, what the units are, etc., and enter data in chronological order. If for some reason the data is not entered in chronological order, note this fact in your notebook.

Indicate any changes from the prescribed procedure that may have occurred. Note fully any difficulties encountered.

Record any identifying numbers and/or calibrations on special equipment.

USEFUL REFERENCES

(Can be found in the Bobst Library collection, unless otherwise noted.)

Experimental physical chemistry, instrumental and error analysis

1. F. Daniels, J. W. Williams, P. Bender, R. A. Alberty, C. D. Cornwell and J. E. Harriman, *Experimental Physical Chemistry*, 7th ed., McGraw-Hill, 1970. QD457.D21
2. D. P. Shoemaker, C. W. Garland and J. W. Nibler, *Experiments in Physical Chemistry*, 6th ed., McGraw-Hill, 1996. QD 457.S56
3. R. J. Sime, *Physical Chemistry: Methods, Techiques, and Experiments*, Saunders College Publishing, 1990.
4. F. A. Bettelheim, *Experimental Physical Chemistry*, Saunders, 1971. QD457.B43
5. D. A. Skoog and J. J. Leary, *Principles of Instrumental Analysis*, 4th ed., Saunders, 1992 QD79.I5S58 1992. (at Cooper)
6. J. R. Taylor, *An Introduction to Error Analysis*, 2nd ed., University Science Books, 1997. QC39.T4 1997

Quantitative analysis

1. D. A. Skoog, D. M. West and F. J. Holler, *Analytical Chemistry*, 6th, ed., Saunders, 1994. QD101.2.S55 1994

Physical chemistry, Quantum Chemistry and Spectroscopy

1. R. J. Silbey, R. A. Alberty, *Physical Chemistry*, 3rd ed., John Wiley & Sons, 2001. QD453.2.A45 2001
2. I. N. Levine, *Physical Chemistry*, 5th ed., McGraw-Hill, 2002. QD453.2.L48 2002
3. P. W. Atkins, *Physical Chemistry*, 6th ed., Freeman, 1998. QD453.2.A88 1998
4. G. M. Barrow, *Physical Chemistry*, 6th ed., McGraw-Hill, 1996. QD453.2.B37 1996
5. G. Herzberg, *Molecular Spectra and Molecular Structure*, Van Nostrand, 1950. QC451.H463 1950
6. D. A. McQuarrie and J. D. Simon, *Physical Chemistry*, University Science Books, 1997. QD453.2.M394 1997
7. D. A. McQuarrie, *Quantum Chemistry*, University Science Books, 1983. QD462.M27 1983
8. N. Colthup, L. Daly and S. Wiberley, *Infrared and Raman Spectroscopy*, 3rd ed., Academic Press, Inc. 1990. QD272.S6.C64 1990

UNDERGRADUATE LABORATORY SAFETY INSTRUCTIONS

To avoid injury to yourself and fellow students you are required to read, understand and sign this agreement. Failure to comply with these rules while performing laboratory experiments may result in suspension or expulsion from this laboratory course.

1. If you have a medical problem or condition that may effect your performance or safety in the laboratory, you must discuss it in private with your laboratory coordinator. This information will be held in strict confidence.
2. YOU MUST WEAR APPROVED SAFETY GOGGLES AND LAB COAT AT ALL TIMES WHILE DOING EXPERIMENTS. NO CONTACT LENSES are to be worn in the laboratory.
3. BARE FEET OR ANY TYPE OF OPEN SHOES OR SANDALS CANNOT BE WORN INTO A CHEMICAL LABORATORY.
4. NEVER WEAR CUT-OFF TEE SHIRTS, HALTERS, OR SHORT PANTS IN AN INSTRUCTIONAL LABORATORY. In order to minimize the possibility of chemical burns on the body, you are expected to dress sensibly.
5. In case of any accident or spill, NOTIFY THE LAB INSTRUCTOR IMMEDIATELY. Note location of eye fountains and safety showers so that you can use them if needed.
6. Eye injuries, whether chemical or mechanical, must always be considered serious. The best procedure IN CASE OF CHEMICAL INJURY TO THE EYE IS IMMEDIATE PROLONGED CONTINUOUS FLUSHING WITH WATER (15-20 minutes) at an eye fountain. Eyes must be forced open to be washed well.
7. Throw away cracked or chipped glassware immediately and obtain replacements from the stockroom. Broken glassware must be placed in the special trash can labelled *Broken Glass Only*.
8. Do not touch any chemical with your fingers. Use a spatula to transfer solids and wear gloves. FLUSH WITH WATER ANY PART OF YOUR BODY THAT COMES IN CONTACT WITH A CHEMICAL USED IN THIS LABORATORY. Plenty of running water is the best first aid treatment for all chemical accidents. Rapid and immediate treatment is essential. USE A LOT OF WATER. Clothing soaked with strong acid or alkali must immediately be removed. This is no time for modesty. The safety shower in the lab is mainly intended to be used in cases where corrosive chemicals are spilled or splashed over a large body area.
9. NEVER EAT OR DRINK IN THE LABORATORY. No food or drink is to be brought into the laboratory.
10. Exercise great care in noting the odor of fumes, and AVOID BREATHING FUMES OF ANY KIND. Use fume hood when necessary.
11. Never force glass rods or tubing into rubber stoppers. Always use a lubricant (grease or glycerin) and protect hands with a towel.

12. DO NOT RUN in the laboratory. Do not engage in any activities or behavior that might confuse, startle, or distract student.
13. DO NOT PUT BACK ANY CHEMICAL, SOLID OR LIQUID, INTO THE STOCK BOTTLES from which they were obtained. The excess chemical may now be contaminated.
14. REPLACE STOPPERS, lids, covers, etc. on the proper containers immediately after using the containers.
15. Never remove chemicals from the laboratory.
16. BE CAUTIOUS: assume all chemical are toxic, and all organic liquids are flammable.
17. Clean up chemical spills immediately. Check with your instructor for the proper procedure.
18. Ask your Lab Instructor about the disposal of used chemicals. All waste chemicals must be placed in containers labeled specifically for each waste material.
19. SHOULD A FIRE ALARM SOUND while you are working in the lab, turn off any hot-plate stirrer, remove any reaction from any heat source, and then leave the building by the nearest exit.
20. An instructor must always be present for students to work in the laboratory. No unauthorized experiments are permitted.
21. Always leave your work area clean at the end of each lab.
22. WASH YOUR HANDS WHEN LAB WORK IS FINISHED. It is a good idea to wash your hands whenever they have been in contact with any chemical, not just at the end of the lab period.

My signature below indicates that I have read the above rules, have been informed of these rules by my lab instructor, and that I will observe and abide by these rules.

Student's Signature: _____ Date: _____

Instructor's Signature: _____ Course # CHEM-UA 661

Experiments and Schedule

EXPERIMENT	REFERENCE
0. Computational Chemistry: Spartan	Lab manual
1. Electrochemistry: Silver Equilibrium (LQ)	Lab manual
2. Solid-Liquid Equilibrium (LQ)	Lab manual
3. Magnetic Susceptibility	Lab Manual
4. Vibration-rotation spectra	Lab manual
5. Spectrum of a Particle-in-a Box	Lab manual
6. Fluorescence of Anthracene	Lab manual
7. Keto-enol Equilibrium by NMR	Lab manual
8. Dipole Moment of Polar Molecules in Solution	Lab Manual

LQ indicates LabQuest Module

Week/Group	A	B	C	D	E
Week starting					
4 Sep 17 ^a	No lab	No lab	No lab	No lab	No lab
11 Sep 17	check-in, NMR Tutorial				
18 Sep 17	0	0	0	0	0
25 Sep 17	1	1	1	1	1
2 Oct 17	2	2	2	2	2
9 Oct 17 ^b	Fall Recess				
16 Oct 17	3	3	3	3	3
23 Oct 17	4	5	6	7	8
30 Oct 17	5	6	7	8	4
6 Nov 17	Orals	Orals	Orals	Orals	Orals
13 Nov 17	6	7	8	4	5
20 Nov 17	7	8	4	5	6
27 Nov 17	8	4	5	6	7
4 Dec 17	Orals	Orals	Orals	Orals	Orals
11 Dec 17	Check-out	Check-out	Check-out	Check-out	Check-out

^aNote: Due to the Labor's Day holiday, there will not be lab for both Monday and Tuesday sections.

^bNote: Due to Fall Recess, there will not be lab for both Monday and Tuesday sections.

Spartan

These exercise will be performed by each student individually in the Physical Chemistry Lab, Brown 455.

Experiments 1-3:

Students are required to do these experiments. Students will work as partners.

Experiments 4-8:

These experiments are done with your partner. Students are to perform only **four out of five** experiments in this group. Choose with your partner ahead of time which one experiment you wish to skip, and **let your instructor(s) know by email** that you will be skipping that experiment. Two of the laboratory reports for this group of experiments will be written reports, and two will be oral presentation.

Oral Presentations:

- ♣ The first oral presentations will be based on the experiments performed during the weeks beginning October 23. This presentation will be given to the instructors.
- ◇ The second oral presentation will be based on the experiments performed during the weeks beginning November 13. This presentation will be given to the instructors.
- ♠ If you choose to skip your assignment experiment during either of these weeks, your oral presentation will be on the experiment performed the following week. However, the date of the oral presentations will not be changed.

You will be given 15-16 minutes for your presentation. There will then be 5 minutes of feedback followed by ~10 minutes of questions. You may use **no more than 8** slides together (each 4 slides). Practice your presentation. The goal is a polished presentation that is clear and informative at the level of a beginning physical chemistry student. Refer to the Laboratory Manual, page 7, for guidelines for oral presentations. A list of grading criteria will be available in advance.

Written Reports:

You should refer to the Laboratory Manual, pages 6 - 7, for information on how to write a laboratory report. Your reports must include an abstract, a title, an introduction, the procedure that were used, your *original* data, results (including sample calculations and a summary table or results), a discussion of errors (typically with the propagated probable error), graphs, and the answers to any questions or exercises in the text and handouts. Laboratory reports must be neat and legible. Reports should be concise but complete. Copies of the relevant pages from your laboratory notebook *must* be turned in with your report.