

**METHODS AND APPLICATIONS IN PHYSICAL CHEMISTRY**

**Topics:** Classical thermodynamics applied to non-ideal systems; Statistical Thermodynamics; Kinetic Theory of Gases and Transport Properties; Radiochemistry.

**GENERAL INFORMATION**

**PROFESSOR:** Sally Chapman

**OFFICE:** 802 Altschul

**PHONE:** 212-854-2098

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**OFFICE HOURS:** Monday 2-4, Tuesday 10-12, and by appointment.

*Please come to me for help as soon as you need it.* A lot of discussion, thinking, and especially working through problems are needed to fully assimilate abstract material.

I am always happy to see you during scheduled office hours. I am often available in my office at other times as well, so stop by and check to see if I am busy. I will help you if I am free, but sometimes I will have other work or appointments that must take priority. If you are unable to see me during my scheduled office hours, and have had trouble finding me, please call and make a special appointment. *Turn off your cell phone in my office.*

I much prefer answering chemistry questions and discussing problems in person, with a pen and paper handy. Phone and e-mail are appropriate for brief administrative questions or for emergencies.

**CLASS TIMES:** MWF 11:00 to 11:50 *and* M 12:00 to 12:50.

**ROOM:** 805 Altschul

You are expected to attend all the lectures. Cell phones must be turned off in class.

The Monday noon class will be used to discuss the assigned problems (past or pending), or other helpful, interesting, or challenging problems; to review and explain the mathematical techniques useful in this course; and to answer any questions raised by the lectures and by your reading. This problem session is *not optional*; it is an integral part of the course.

If you have a question, whether in lecture or in the problem hour, ALWAYS ASK.

**READING:** The suggested textbook and other sources are listed below. Consult the table of contents or index for specific pages.

**WEB SITE:** <http://bc.barnard.columbia.edu/~schapman/bc3254/index.htm> Copies of handouts, announcements, information about exams (before and after), copies of lecture slides, files for download and other resources are on the course web site. If you have your own computer, bookmark it! Problem sets and answers will be available on Courseworks only.

**PROBLEMS:** Problem sets are assigned approximately weekly, as given in the schedule. They are available on-line. Working out problems is the heart of this course. If you cannot do the problems, then you do not understand the material. Computers (Excel, possibly Spartan) will be of use for some problems.

This term, some reading and reporting on relevant articles from the primary literature will be interleaved with regular problems. Details to follow.

Your solutions to the problem sets must be handed in at the start of class on the scheduled due date. Late work will not be accepted. If you have a legitimate excuse for a missing problem set, you will not be penalized. Solutions to all the problems will be available on Courseworks. Many additional problems for practice and review are in many of the textbooks listed below.

Your solutions to the problem sets will be graded. Please turn in all of the work you have done on each problem, whether your answer is complete or not. If the problem asks you to use a prepared computer program or spreadsheet, be sure to start work in plenty of time to get access to a computer with the necessary software.

Working out problems is a major part of how you learn the material, and is how you check that you have mastered it. You should make a serious effort to solve every problem, on your own, before you turn to get help. You may work together on problems, but the best strategy to really learn this material is to get by with the minimum help and suggestions from anyone else. Copying someone else's answer (including answers found on the WWW) is an Honor Board violation.

**EXAMINATIONS:** There will be one in-class examination and one take-home exam:

Examination I: Monday March 10, 11:00 to 12:50.

Take Home Exam Due: Wednesday April 16

and a three-hour final examination

Final Examination (tentative): Monday May 12, 9:00 - 12:00

Problems similar to those in the problem sets will comprise the major portion of exams.

**GRADES:** Your overall course grade will be based on the following allocation of credit:

Problem sets 24 %; readings and possible project 10 %;

in-class examination 17 %; take-home exam 17%, final examination 32 %.

**TEXTBOOK:** P.W. Atkins and J. DePaula, *Physical Chemistry* 8th ed. (Freeman, 2006)

Available at the Columbia (Barnes and Noble) bookstore.

For some course material, you may need to consult supplementary books and the primary scientific literature. The books listed below are suggestions if you want to read another presentation of the same material or to study some topic in greater detail.

**Suggested additional texts:** most of the books listed on the following page are in the Columbia University Chemistry Library, 4th floor Chandler. Many are also in Barnard's Lehman library; check CLIO. I have not put these on reserve. Please let me know if you are unable to find a book.

I always welcome comments on any readings you find particularly helpful. I also appreciate your pointing out any errors you find in the slides, problem sets, or textbook. I will post corrections on the web page.

**Physical chemistry texts**

- Alberty, R.A., Silbey, R.J. and Bawendi, M.G. *Physical Chemistry*, 4th Ed. (Wiley, 2004)
- Berry, R.S., Rice, S.A., and Ross, J., *Physical Chemistry* (Wiley, 2002)
- Levine, I.N., *Physical Chemistry*, 5th ed. (McGraw-Hill, 2002)
- Noggle, J.H., *Physical Chemistry*, 3<sup>rd</sup> Ed. (Little, Brown, 1996)
- Tinoco, I, Sauer, K., and Wang, J.C. *Physical Chemistry: Principles and Applications in Biological Sciences*, 4th ed. (Prentice-Hall, 2002)
- Engel, T. and Reid, P., *Thermodynamics, Statistical Thermodynamics, and Kinetics* (Benjamin Cummings, 2006)

**Texts on Special Topics**

- Chandler, D., *Introduction to Modern Statistical Mechanics*, (Oxford, 1987)
- Dill, K.A. and Bromberg, S., *Molecular Driving Forces: Statistical Thermodynamics in Chemistry & Biology* (Taylor & Francis, 2002)
- Widom, B., *Statistical Mechanics: A Concise Introduction for Chemists* (Cambridge University Press, 2002)
- Maczek, A., *Statistical Thermodynamics* (Oxford Chemistry Primers, 1998)
- McQuarrie, D.A., *Statistical Mechanics* (University Science Books, 2000)
- Goodisman, J., *Statistical Mechanics for Chemists* (John Wiley, 1997)
- Ehmann, W.D. and Vance, D.E., *Radiochemistry and Nuclear Methods of Analysis*, (John Wiley, 2002), or earlier editions
- Adloff, J, Guillaumont, R., *Fundamentals of Radiochemistry* (CRC Press, 1993)
- Navratil, O., Hala, J., Kopunec, R., Macasek, F., Mikulaj, V., and Leseticky, L, *Nuclear Chemistry*, (PTR Prentice Hall 1992)
- Knoche, H., *Radioisotopic Methods for Biological and Medical Research* (Oxford, 1991)