Chem 4590/6590
Spring Semester 2014
Statistical Mechanics (Special Topics in Physical Chemistry)
3 Semester Credits

Instructor: Stuart Allison

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Office Hours: TuTh from 2:00 to 4:00 PM or by appointment

Lecture Time and Location: TuTh from 4:00 to 5:15 PM in 331 Langdale

Course Prerequisites: Chem 4120/6120 or equivalent with a grade of B or higher.

Text: *Statistical Mechanics* by D.A. McQuarrie, University Science Books, 2000 (Earlier versions published by Harper and Row can also be used.)

Course Description: Chem 4590/6590, Special Topics in Physical Chemistry, shall deal with an introductory, but in depth study of *statistical mechanics* this semester. The overall objective is to cover: (1) introductory statiscal mechanics (chapters 1 through 6 and also chapters 8 and 9), (2) classical statistical mechanics (chapter 7), (3) imperfect gases (chapter 12), and (4) introduction to the theory of liquids (chapters 13 through 15).

Homework, Problem Sessions, Student Presentations, and Grading:

> 1) Homework. On the one hand, problem solving is an essential ingredient to learning the subject of statistical mechanics. On the other hand, the level of difficulty of the problems typically encountered does not make them very suitable for in class exams. Consequently, one *assigned problem* will be given each week after each Thursday lecture. These will be due at the beginning of the next Tuesday lecture and will be worth a maximum of 10 points. One of you will be assigned to serve as *grader* for each problem and this assignment shall be rotated through the class. The grader does not have to turn in the problem, but is responsible for grading the problem of the other students. I can meet with the grader and help them if they have questions. Provided the grader fulfills their responsibility, they will receive 10 points for that problem. Assigned problems not turned in on time (beginning of the Tuesday after they are assigned) will not be accepted and a grade of 0 will be assigned.

> 2) Problem Sessions. In addition to *assigned problems*, there will also be a number of *recommended problems* that shall be given to you throughout the course. These will not be graded in the same way as the assigned problems. However, three special *Problem Sessions* are scheduled on 2/11, 3/13, and 4/22. During these problem sessions, I will ask for volunteers to work some of these recommended problems for the class and you will

be graded on your performance. Your participation in at least two out of three of these problem sessions will be required.

3) Student Presentations. Each of you will be required to select a published literature paper dealing with the subject of statistical mechanics and present a 10 minute (approximate) presentation on the paper of your choice on Thursday May 1, 2014 during the time allocated to the Final Exam. Before 3/13/14, the last class before Spring Break, you should meet with me and obtain approval of your paper. On the last day of regularly scheduled classes, Thursday April 24, 2014, please distribute to the class a hard copy of the first page (containing Abstract) of the paper you will be discussing. Each presentation will be evaluated on the basis of organization, clarity, and significance. I as well as the other students in the class will grade your presentation.

4) Grading. For 4590 students, the grade breakdown will be 40% assigned problems, 30% problem sessions, 30% presentations. For 6590 students, each category will be given equal weighting (33.33% each).

<u>Tentative Course Schedule</u>:

Dates	Chapter	Subject
1/14, 16	1	Introduction, Review, Mathematics
1/21, 23	2	Canonical Ensemble
1/28, 31	3	Other Ensembles
2/4, 6	4	Fermi-Dirac, Bose-Einstein, Boltzmann Statistics
2/11	1-4	First Problem Session
2/13	5	Monatomic Gases
2/18, 20	6	Diatomic Gases
2/25	8	Polyatomics
2/27, 3/4	9	Chemical Equilibrium
3/6, 11	7	Classical Statistical Mechanics
*3/13	5-9	Second Problem Session
3/18, 20	--	Spring Break
3/25, 27	12	Imperfect Gases
4/1, 3	13	Distribution Functions for Classical Liquids
4/8, 10	14	Perturbation Theories of Liquids
4/15, 17	15	Strong Electrolytes
4/22	12-15	Third Problem Session
4/24	--	Summary (Students provide class "first pages" of their presentations)
**5/1	--	Student Presentations

*Deadline to receive approval of the manuscript for your presentation on 5/1

**The student presentations shall be delivered during the time scheduled for the final exam (from 4:15 to 6:45 PM)