CHM 6461: Introduction to Statistical Thermodynamics, Spring 2017

Instructor: Prof. Russ Bowers
Email: bowers@chem.ufl.edu
Office Hours: Physics Building, Rm. 2360, TR 1-3 pm (other times by appointment)
Meeting Place and Time: Flint Hall Rm 0111, MWF 8th Period (3:00 – 3:50)

Classes begin/end: January 4/April 19

Holidays
Jan.16: MLK day
March 4-11: Spring break

Course Description
This course gives a self-contained exposition of topics that are generally considered fundamental in modern equilibrium statistical thermodynamics. After a brief review of the role of entropy in the macroscopic (thermodynamic) description, the bridge to the microscopic (statistical) point of view is established. Standard subjects, such as the canonical and grand canonical ensembles, partition functions, and quantum statistics are introduced, followed by applications in chemical physics.

Grading scheme
Midterm Exam  25%
Final Exam    25%
Quizzes (2)   30%
Homework     20%

Required Texts

Supplemental Texts

Recommended Software: Wolfram's Mathematica.

Attendance: 100% attendance is expected.

Make-up Exams: Must be arranged in advance of the scheduled date. Allowed only in emergency situations.

UF Grading Policies: https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx
## Tentative Schedule

<table>
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<tr>
<th>Week</th>
<th>Topic</th>
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| 1-2  | Microscopic and macroscopic variables  
Postulate of maximum entropy  
Internal constraints and entropy  
Quasi-static, reversible, and irreversible processes  
Stability criteria |
| 3    | Probability and statistics |
| 4    | Concepts in statistical mechanics  
Microcanonical ensemble  
Applications |
| 5-6  | Time evolution in quantum mechanics  
Density operator and time evolution  
Boltzmann distribution  
Statistical entropy  
Time evolution of statistical entropy  
Equilibrium distributions |
| 7-8  | Canonical and grand canonical ensembles  
Partition functions  
Relationship to thermodynamic potentials |
|      | **EXAM 1** |
| 9-11 | Monatomic ideal gas  
Quantum phase space  
Diatomic and polyatomic molecules  
Vibrations in solids  
Paramagnetism  
Ferromagnetism and Ising model  
Spin waves |
| 12-13| Identical particles, quantum statistics  
Bose-Einstein and Fermi-Dirac distributions  
Maxwell-Boltzmann limit  
Ideal Fermi gas |
| 14-15| Chemical equilibrium  
Rates of chemical reactions  
Absolute rate theory |
|      | **EXAM 2** |