

COLLEGE OF CHEMISTRY COURSE GUIDE (../INDEX.HTML)

MAJORS (../MAJOR.HTML)

LIST OF COURSES (COURSES.HTML)

RESOURCES (../RESOURCES/RESOURCE.HTML)

STUDENT LIFE (../STUDENTLIFE/ORGS.HTML)

CHEM 220A - THERMODYNAMICS AND STATISTICAL MECHANICS (3 UNITS)

COURSE OVERVIEW

SUMMARY

Chem 220A is a graduate level thermodynamics and statistical mechanics course designed to introduce first year graduate students in physical or theoretical chemistry to statistical mechanics as applied in modern physical chemistry. The course assumes some very basic quantum mechanics, and a little thermodynamics, as background. Material is presented in the course predominantly through lecture (3 hours a week) and an optional weekly discussion section. Your final grade is largely based off of exams (80%), with a contribution from weekly problem sets (20%).

PREREQUISITES

Formal: Graduate standing, chem 120B, or consent of instructor.

TOPICS COVERED

- Basic postulates of statistical mechanics, counting microstates
 - Connection to classical thermodynamics
 - First and second laws of thermodynamics
 - Mathematical structure of thermodynamics
- Quantum and classical approaches to ensembles
 - Distributions and fluctuations

- Ergodic hypothesis
- Microcanonical, canonical, and grand canonical ensemble
- Ensemble equivalence
- Fluctuations of macroscopic observables
- Non-interacting systems
 - Free gas
 - Harmonic oscillators and the Bose-Einstein distribution
 - Electrons in metals and the Fermi-Dirac distribution
- Stability and coexistence
 - Chemical equilibrium
 - Phase equilibrium
- Phase transitions and the Ising model
 - Phenomenological observations
 - Lattice gas (Ising) model
 - Symmetry breaking
 - Approximate solutions
 - Renormalization group theory
- Numerical simulations
 - Monte Carlo methods
 - Importance sampling
- Intro to liquid theory
 - Distribution functions
 - Structure in disordered systems
 - Van der Waals equation of state

WORKLOAD

COURSEWORK

- Weekly problem sets (20%)
- Two midterms (40%)
- One final exam (40%)

TIME COMMITMENT

Weekly problem sets usually take a few (2-4) hours. 3 hours of lecture per week, and 2 hours of optional discussion per week.

CHOOSING THE COURSE

WHEN TO TAKE

After you have taken chem 120B, and want to continue with statistical mechanics.

WHAT NEXT?

- Chem 220B (chem220b.html)

ADDITIONAL COMMENTS AND TIPS

This course is similar in structure and content to chem 120B, but delves more deeply into the mathematical foundations of many topics. Further, the discussion of the Ising model in 220A is absent from 120B.

Written by: Brighton Skeel

Last edited: Fall 2018

COLLEGE OF CHEMISTRY PEER SERVICES

Made by Angela Lee, c/o 2019



(<https://www.facebook.com/CalSMB/>) (<https://twitter.com/CalSMB>) (<https://www.stanford.edu/ugrad/curriculum/peer-advising>)