

Chemistry 171 course guidelines

Instructor:	Prof. Vijay Pande (pande@stanford.edu)
Office:	Room S295, Clark Center
Office Hours:	MW 1:00pm - 2:00pm
Teaching Assistants:	Oh Kyu Yoon (okyoon@stanford.edu) Nate Bartlett (nbartlet@stanford.edu) Daniel Miller (dmiller2@stanford.edu)
Lectures:	MW 11:00-12:15
Problem Section:	F 11:00-11:50 (Optional)
Textbooks:	E. Brian Smith <i>Basic Chemical Thermodynamics</i> , and Levine <i>Physical Chemistry</i> (both required)

Assignments:

Readings from Smith, handouts, and problems. The problem sets are to be handed in for grading at the beginning of the lecture on the due date. The teaching assistants will go over the problems (as well as answer questions about course material) during the Friday problem session.

Examinations and grading:

There will be two in-class examinations during the quarter and a final examination during the regular final exam period. The class will be graded as follows:

Two in-class exams (15% each)	30%
Final Exam	40%
Problem Sets	30%
<hr/>	
TOTAL	100%

The course will be graded on this basis. Homework is very important since it is a way to make sure that you understand the material as we go along. Homework is due at the beginning of class on the due date (typically Monday, unless noted otherwise). Late homework will not be accepted without prior approval of the instructor. The lowest homework grade will be automatically dropped.

The two in-class examinations will be given on Monday, October 23 and Monday, November 13. The final exam will be given on Thursday, December 14, from 8:30-11:30am. Students who wish to have an exam re-graded must have written their exam in permanent ink, and give notification within one week after the papers have been returned to the class, along with a note detailing the reason for the re-grading request. All exams handed in for re-grading will be entirely re-graded. No examinations will be accepted for re-grading after this one week period.

Course Outline

1. Introduction

Equilibrium, reversibility, ideal gas, van der Waals gas
(Smith Chapter 1, Levine Chapter 1 and 2.1)

2. Energy

Work, heat, temperature, zeroth and first laws of thermodynamics, conservation of energy, enthalpy, heat capacity, state functions
(Smith Chapter 2, Levine Chapter 2)

3. Entropy I: Entropy in terms of heat

Reversibility and equilibrium (again), entropy, entropy interpreted in terms of heat flow
(Smith Chapter 3.1-3.9, Levine Chapter 3.1-3.5)

4. Entropy II: The molecular basis of entropy

Molecular basis of entropy, statistical basis for the second law, third law, heat engines, entropy of a gas expanding
(Smith Chapter 3.10-3.13, Levine Chapter 3)

5. Equilibrium I: The concept of free energy

Free energy, Helmholtz free energy, Gibbs free energy, phase equilibria
(Smith Chapter 4.1-4.5, Levine Chapter 4.1-4.3)

6. Equilibrium II: Applications of free energy concepts

Clapeyron equation, Clausius-Clapeyron equation, chemical potential, equilibrium between reactants, basic results of chemical thermodynamics
(Smith Chapter 4.6-4.15, Levine Chapter 4)

7. Ideal systems

what is an ideal solution, properties, mixtures of liquids, change in freezing/boiling points, osmotic pressure, solubility of solids
(Smith Chapter 6, Levine Chapter 7.3, Chapter 8, and Chapter 9)

8. Non-ideal systems I: Chemical equilibrium

Chemical equilibria in solution, electrochemical cells
(Smith Chapter 7)

9. Non-ideal systems II: Phase transitions

what is a phase transition, first and second order phase transitions, phase transitions in chemistry and biology
(lecture notes)

10. Molecular basis of thermodynamics (time permitting)

microstates, macrostates, Boltzmann factor, partition function, free energy, energy, entropy
(Smith Chapter 9)