

Chemistry 0330: Equilibrium, Rate, and Structure

Fall 2014: Section 1 syllabus

By Lai-Sheng Wang

Prerequisite: To enroll in Chem 0330, you will need to have scored 4 or 5 on the AP Chemistry test or passed Chem 0100.

Course instructor: Prof. Lai-Sheng Wang, GC 249B (e-mail: chem0330S01@brown.edu)

Lab Instructor: Prof. Li-Qiong Wang, GC 337 (e-mail: li_qiong_wang@brown.edu)

Textbook: S. S. Zumdahl/D. J. DeCoste, *Chemical Principles*, 7th Edition

Lectures: MWF, 10:00 – 10:50 am, MacMillan 117

Office hours: Mon: 11 am -12 noon; Wed: 4-5 pm. GeoChem 246

Chem 330 open help: Additional instruction assistance will be provided by Dr. Suzanne Rudnicki (e-mail: suzanne_rudnicki@brown.edu). Dr. Rudnicki will conduct problem-solving sessions, as well as office hours. Additional office hours will be provided by TAs.

Home works: There will be a weekly homework set and reading assignments

Exams: Two 50 min in-class exams (to be held on Sept. 29 and Oct. 27)
A 3 hr comprehensive final exam (time and place to be announced)

Grading: 20% Lab portion
15% home work (Delays only permitted under University policies)
30% mid-terms
30% final
5% iClicker/quizzes

Additional resources: An iClicker device is required
Course website: canvas.brown.edu/courses/

Stand-in lectures: Due to prearranged conference travels, Prof. Li-Qiong Wang will give the lectures on Oct 20, 22, and Nov. 7.

Course Description

Chem 0330 provides an overview of the fundamental physical principles underlying chemical reactions, molecular structures, and chemical bonding. The course presents important ideas of thermodynamics and its application to chemical equilibrium involving chemical reactions in the gas phase and condensed phase, including electrochemistry. Basic ideas of quantum mechanics will be introduced and used to understand the structure of the periodic table, the electronic structures of atoms and molecules, and models of chemical bonding. The goal of the course is to prepare students with a sound chemistry foundation for more advanced chemistry courses or other subjects related to chemistry.

Tentative Outlines

1. Introduction (2 lecture hours)

The periodic table, stoichiometry and chemical reactions, the ideal gas law
(Chapters 2-5 in a nutshell)

2. Thermodynamics (9 lecture hours) (Chapters 9 and 10)

Energy, heat, and work
Laws of thermodynamics
Enthalpy, entropy, and free energy

3. Chemical equilibrium (10 lecture hours) (Chapters 6, 7, 8, and 11)

Equilibrium constant
Le Chatelier's principle
Acid-base equilibrium and buffered solutions
Redox reactions and electrochemistry: Galvanic cells and batteries

4. Chemical kinetics (3 lecture hours) (Chapter 15)

Chemical reaction rate laws
Reaction mechanisms
Transition-state theory
Catalysis

5. Molecular structures and chemical bonding (12 lecture hours) (Chapters 12, 13, 14)

Basics ideas of quantum mechanics and electronic structure of atoms
Origin of the periodic trends of the elements and the periodic table
Chemical bonding model: the Lewis structures and the VSEPR model
The molecular orbital model and covalent bonding

6. Put it all together (1 lecture hour) (research talk)

Atomic clusters and nanoscience