Ch 24a (3-0-6)
Winter Term 2009/10

Introduction to Biophysical Chemistry

Ch 24a discusses the interaction of light with matter (absorption, emission, scattering), methods of identification of macromolecules (absorption spectroscopy, mass spectrometry), methods of structural determination of macromolecules (x-ray diffraction, neutron diffraction, scattering from solutions of macromolecules, multi-dimensional NMR, EPR, linear and circular dichroism, optical rotatory dispersion, fluorescence resonance energy transfer, and single-molecule methods), reaction rates and mechanisms, and the methods of rapid and ultrafast kinetics. The concepts and mathematical manipulations will be illustrated with biochemical and biophysical applications. This material is covered in Chapters 9-15 and Chapter 7 of the textbook by James P. Allen, and Chapters 10–13 and 16–17 of the textbook by Eisenberg and Crothers.

GENERAL INFORMATION

Instructors
Sunny I. Chan, SunnyChan@yahoo.com, 234A Noyes, ext. 6508
Douglas C. Rees, dcrees@caltech.edu, 363 Broad, ext. 8393

Graduate Teaching Assistants
Jeen Joo Kang, jiskang@caltech.edu, 312 Church, ext. 6032
Kay Limapichat, walrati@caltech.edu, 254 Crelin, ext. 6009
Christina Ting, cting@caltech.edu, 018/014 Spalding, ext. 8404

Undergraduate Teaching Assistants
ZeNan Chang, zlchang@caltech.edu.
Changyi Li, changyi@caltech.edu.

ZeNan and Changyi will hold office hours every Sunday from 9:30 -11:30 p.m. in the Ruddock House Library.

Class Hours
Ch 24a meets Mondays, Wednesdays, and Fridays at 1:00 p.m. in Broad 100. There will be recitation sessions approximately every three weeks, according to the attached syllabus. The recitation sessions will focus on the elaboration of complex concepts and subtle points made during the lectures, as well as solving the types of problems that will appear on homeworks and exams. You are strongly encouraged, if not expected, to attend ALL the lectures and recitations.


Other: A selection of useful texts will be placed on reserve in Millikan Library (list attached below).

Grading
There will be a midterm and a final examination. Your grade is based on: homework (40%), midterm (30%), and final (30%). To encourage class and recitation participation (attendance, questions, comments, etc.), a bonus of up to 10% will be added to your final grade based on your participation, prorated according to your actual attendance. A problem set will be due approximately every three weeks. If you fail to obtain a copy of a homework set when it is handed out in class, you may download it from the course website. The midterm and final exams will not be found on the course website. See Ms. Priscilla Boon in 234 Noyes if you did not pick up the midterm or final exam in class.

Completed assignments and midterm exams should be handed in during class hours, unless alternative arrangements are made with Jeen Joo Kang, the Head Teaching Assistant. Graded homework and exam papers will also be returned in class. Outside of class hours, you may pick up graded assignments from Mr. Kang. Please staple all work.

Ch 24a Web Site
Handouts, problem sets, answer keys, lecture notes and other useful material for this course may be found at:

http://chemistry.caltech.edu/courses/ch24/a.html

Problem Sets
Homework will be handed out during class/recitation on a Friday (see schedule) and due 10 days later on Monday by 1:00 p.m. Solutions will be released at 5:00 p.m. Friday of the same week. Late assignments will be accepted, with the following penalties for a 100-point assignment:

- 30% if turned in by Tuesday 1:00 p.m. following the Monday due date;
- 50% if turned in by Wednesday 1:00 p.m. following the Monday due date;
- 70% if turned in by Thursday 1:00 p.m. following the Monday due date;
- 90% if turned in by Friday 1:00 p.m. following the Monday due date;
- 100% if turned in after Friday 1:00 p.m. following the Monday due date.

All homework must be turned in. Failure to do so will result in a grade of “F” or “I”.

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Excuses for Late Homework

Excuses for late homework must be arranged in advance and in writing, signed by Dr. Chan or Dr. Rees. Extensions will only be granted for medical reasons or personal/family emergencies; situations (such as clashes in assignment due dates or travel for interviews) that can be foreseen days or weeks beforehand will NOT be considered. The maximum period of extension allowed is 4 days (as solutions will be released on Fridays). A maximum of 2 extensions will be allowed for the three homework assignments during the term. Staple the excuse to your homework. NO extensions will be allowed for the midterm or the final. There will be no exceptions.

Ch 24 and the Honor System

Students are encouraged to cooperate on the homework; however, outright copying of solutions to the homework problems from another student, textbook, material from any previous years of Ch 24a/b, etc. is NOT permissible. Each individual is expected to personally complete the homework he/she hands in, and he/she should be able to explain the homework handed in.

The examinations must be taken individually and without discussion among students.

Ombudsman Meeting

A student representative will be chosen to serve as a liaison between the class and the CCE Executive Officer (Dr. M. Okumura) and the CCE Division Curriculum and Undergraduate Studies Committee. If you have any complaints or suggestions about the course, please direct them to your ombudsman. However, given the timing of the ombudsman meetings, it is unlikely that this feedback will be received by the instructor in a timely fashion to help the course. Therefore, please feel free to see Dr. Chan or Dr. Rees at any time to discuss any issues related to this course. The teaching assistants also provide excellent sounding boards for feedbacks, as they communicate with the instructors on a regular basis.
Books Placed on Reserve in Millikan Library

1st Floor Reserve

8th Floor Reserve
David Eisenberg and Donald Crothers. Physical Chemistry with Applications to Life Sciences (1979).

8th Floor (non-reserve)

9th Floor (non-reserve)
<table>
<thead>
<tr>
<th>Day</th>
<th>Date</th>
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<th>Topic</th>
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<tbody>
<tr>
<td>F</td>
<td>Jan 8</td>
<td>Quantum mechanics. Simple applications.</td>
<td>M</td>
<td>Feb 15</td>
<td>President’s Day. (Holiday).</td>
</tr>
<tr>
<td>M</td>
<td>Jan 18</td>
<td>Martin Luther King Day. (Holiday).</td>
<td>W</td>
<td>Feb 24</td>
<td>X-ray diffraction. (Drop Day).</td>
</tr>
<tr>
<td>W</td>
<td>Jan 20</td>
<td>Infrared and Raman spectroscopy. Total attenuated FTIR.</td>
<td>F</td>
<td>Feb 26</td>
<td>Recitation 3.</td>
</tr>
<tr>
<td>F</td>
<td>Feb 5</td>
<td>Recitation 2.</td>
<td>T</td>
<td>Mar 16</td>
<td>(Final due 1 p.m.)</td>
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Reading Assignments


Part 2: Quantum mechanics and spectroscopy

Chapter 9. Quantum theory: introduction and principles
Chapter 10. Particle in a box and tunneling
Chapter 12. Atomic structure: hydrogen atom and multi-electron atoms
Chapter 13. Chemical bonds and protein interactions
Chapter 14. Electronic transitions and optical spectroscopy
Chapter 11. Vibrational motion and infrared spectroscopy
Chapter 16. Magnetic resonance
Chapter 15. X-ray diffraction and extended x-ray absorption fine structure

Part 1: Thermodynamics and kinetics

Chapter 7. Kinetics and enzymes


Part Three Microscopic Systems

Chapter 10. Principles of Quantum Mechanics
Chapter 11. Chemical Bonds
Chapter 12. Principles of Spectroscopy
Chapter 13. Biochemical Spectroscopy

Part Five Symmetry and Molecular Structure

Chapter 16. Symmetry
Chapter 17. X-ray Diffraction and the Determination of Molecular Structure