CHE 349, Fall 2005: Physical Chemistry for Life Science

Instructor: Jochen Autschbach

Syllabus Revision 1.4. Last updated: September 20, 2005

Time, Dates, Location, Office Hours, Contact Info

Class Room: NSC 218, North Campus
Lecture Times: M, W, F 10:00 - 10:50
First day of class: Mon, Aug. 29, 2005
Last day of class: Fri, Dec. 9, 2005
Office Hours: T, R, 1400 – 1530, NSC Room 312 or 345
Holidays:
Labor Day Observed: Mon, Sep. 5
Fall Recess: Wed, Nov. 23 – Fri, Nov. 25

Deadline for course resignation: Fri, Oct. 21, 11 pm

Instructor email: jochena@buffalo.edu Phone: 645-6800 x2086

Please use the office hours instead of sending email for questions and problems that require an elaborate answer. Feel free to call me if you cannot visit me during office hours.

Course web site at UBLearns, https://ublearns.buffalo.edu. The course web site will contain downloadable (PDF) versions of the syllabus, homework, and announcements regarding the course.

Textbook

The required textbook for the course is:
Tinoco, Sauer, Wang, Puglisi, *Physical Chemistry: Principles and Applications in Biological Sciences*, 4th Ed., Prentice Hall (2002).

Before each lecture you are expected to study the relevant pages in the textbook as indicated in the ***Schedule*** *section below.* This will take an estimated 2 hours on average. You are strongly encouraged to calculate the examples in each chapter yourself. The lectures will be presented assuming that all students have prepared each lecture accordingly.

Overview, Goals

Physical Chemistry covers many topics that are important in Life Sciences. Why do some reactions proceed in one direction and not backwards? How can we quantify a chemical equilibrium? How fast are chemical reactions in living organisms? How can we measure this? How much energy does an organism consume? How can we detect bio–chemically relevant molecules? How can we measure their properties? How do we know what is the mass and the shape of a protein? Physical Chemistry provides the methods and the theoretical background to answer these and related questions.

By the end of the course you should have a clear understanding of the first and second law of thermodynamics, of the methods of kinetics by which to determine and analyze the rates of chemical reactions, and applications to enzyme kinetics. Further, you will have acquired some basic knowledge of the theory of molecular structure and interactions, and applications of the main results in various spectroscopic methods that are used to detect molecules and to investigate their properties.

Schedule

August	29	Course organization, Introduction, Scope, Chapter **1**
August	31	1st law of thermodynamics, Chapter **2**, 14 – 24
September	2	1st law of thermodynamics, Chapter **2**, 24 – 36
September	7	1st law of thermodynamics, Chapter **2**, 36 – 46
September	9	1st law of thermodynamics, Chapter **2**, 47 – 61
September	12	2nd law of thermodynamics, Chapter **3**, 68 – 77
September	14	2nd law of thermodynamics, Chapter **3**, 77 – 87
September	16	2nd law of thermodynamics, Chapter **3**, 87 – 97
September	19	2nd law of thermodynamics, Chapter **3**, 97 – 113
September	21	Thermodynamics: The Gibbs energy, Chapter **4**, 120 – 139
September	23	Thermodynamics: The Gibbs energy, Chapter **4**, 139 – 151
September	26	Thermodynamics: The Gibbs energy, Chapter **4**, 151 – 165
September	28	Thermodynamics: The Gibbs energy, Chapter **4**, 165 – 179
September	30	Thermodynamics: Physical equilibria, Chapter **5**, 186 – 206
October	3	Thermodynamics: Physical equilibria, Chapter **5**, 206 – 227
October	5	Thermodynamics: Physical equilibria, Chapter **5**, 227 – 244
October	7	**Exam 1: Chapters 2, 3, 4, 5**
October	10	X–Ray crystallography & Macromolecular structure, Chapter **12**, 666 – 679
October	12	X–Ray crystallography & Macromolecular structure, Chapter **12**, 679 – 695
October	14	X–Ray crystallography & Macromolecular structure, Chapter **12**, 699 – 708
October	17	Molecular motion and transport properties, Chapter **6**, 252 – 266
October	19	Molecular motion and transport properties, Chapter **6**, 267 – 283
October	21	Molecular motion and transport properties, Chapter **6**, 283 – 306
October	24	Kinetics: Rates of chemical reactions, Chapter **7**, 314 – 334
October	26	Kinetics: Rates of chemical reactions, Chapter **7**, 334 – 350
October	28	Kinetics: Rates of chemical reactions, Chapter **7**, 351 – 371
October	31	Kinetics: Rates of chemical reactions, Chapter **7**, 372 – 387
November	2	Enzyme kinetics, Chapter **8**, 400 – 412
November	4	Enzyme kinetics, Chapter **8**, 413 – 426
November	7	Molecular structures and interactions: Theory, Chapter **9**, 436 – 458

November	9	**Exam 2: Chapter 6, 7, 8**
November	11	Molecular structures and interactions: Theory, Chapter **9**, 459 – 479
November	14	Molecular structures and interactions: Theory, Chapter **9**, 479 – 503
November	16	Molecular structures and interactions: Theory, Chapter **9**, 503 – 523
November	18	Molecular structures and interactions: Spectroscopy, **Chapter 10**, 530 – 543
November	21	Molecular structures and interactions: Spectroscopy, **Chapter 10**, 543 – 554
November	28	Molecular structures and interactions: Spectroscopy, **Chapter 10**, 554 – 567
November	30	Molecular structures and interactions: Spectroscopy, **Chapter 10**, 567 – 579
December	2	Molecular structures and interactions: Spectroscopy, **Chapter 10**, 579 – 588
December	5	Molecular structures and interactions: Spectroscopy, **Chapter 10**, 588 – 601
December	7	Overview: What have we learned?
December	9	**Third Exam: Chapters 4 – 10**

Exams, Homework, Grades, Policies

The course's grade will be based on 3 exams. I do not explicitly grade your attendance. However, each class of the course builds upon the material covered until that point. Thus, you can expect difficulties if you do not attend the lectures. Typically, you should not expect a grade of A– or better unless you score higher than 80% in the exams. The cut–off for B– will probably be around 65%, C– around 50%, D around 40%. These are estimates, no guarantee! The grading scheme might be curved if necessary. The most successful students will not only be able to carry out correct calculations, repeat a definition, or reproduce graphs and equations that were shown in the lectures, but also understand the motivation behind the concepts introduced in this course. They will be able to transfer their knowledge in order to solve problems that are similar to, but not exactly the same as, problems that were discussed in the lecture or part of an assignment. They will learn from their mistakes and not make them again.

For each exam, you are allowed to bring one (1) letter–size page of hand written notes (equations, definitions) and a pocket calculator. You will have to hand in the page of notes along with the exam.

Exams will not be returned but kept in my office. I will post the grades. If you want to take a look at the corrected exam feel free to do so during the office hours.

Homework is due by the end of the lecture one week after the questions were handed out. Late submission will not be accepted. Homework is voluntary. I will grade homework assignments that are returned to me on time but they will not count for the course grade. "Bonus work", e.g. additional homework, in order to compensate for low grades will not be available for this course.

Academic integrity as defined in UB's official guidelines will be strictly enforced. Make sure you know what is meant by "academic integrity" according to these guidelines.

Grade details:

Three exams, ∼ 50 minutes (30, 30, and 40% of final grade, respectively)

Exam grades will be assigned as a percentage of the highest possible score.

There is *no final exam* after the last day of classes. The first exam will cover Chapters 2 – 5, the second exam will cover chapters 6 – 8, the third exam will cover Chapters 4 – 10.