Physical Biochemistry (CHEM 305)

Fall Semester 2019

Instructor: Jan Florián

Office:	Flanner Hall, room 314B (enter through the room 314A)
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Lecture:	Tue, Th 10:00 – 11:15 AM, Cuneo Hall 109
Discussion:	Tue 1:00 – 1:50 or 2:30 – 3:20 PM, Flanner Hall 007
Office Hours:	Thr 1:00 – 3:00 PM

Textbook: "*Physical Chemistry: Principles and Applications in Biological Sciences*" 5th edition, by Tinoco, Sauer, Wang, Puglisi, Harbison and Rovnyak, Pearson Education Inc. 2014, ISBN-10: 0-13-605606-7

Course Overview: Physical chemistry is a set of general principles and experimental methods for exploring chemical and biological systems. In this class, we will learn and discuss these principles and methods, while emphasizing their molecular interpretation and biochemical applications. We will cover chapters 2 – 4, 9 and 11 – 14 of Tinoco's text; a tentative schedule of lecture topics accompanies this syllabus. Your attendance at lecture and discussion is expected. The correct answers of the exam questions may require knowledge of all information presented in the lecture, discussion, textbook, and Mastering, as well as the necessary general chemistry, physical and mathematical prerequisites. It is recommended that you read (and think about) appropriate chapter of the textbook prior to the lecture covering that chapter, and ask the questions relevant to the covered material during the lecture and the discussion.

Grade components	Maximum number of grading points
Homework	18
Exam 1	20
Exam 2	20
Final exam	42
Total	100 grading points

Homeworks: Homework assignments, each worth two to four grading points will be assigned on Thursdays. To receive full credit, a student's homework has to be submitted in person at the beginning of the next lecture. Each homework must present meaningful steps to solving assigned problems. Late, or less than 1/2 completed homework assignments will receive zero points. Students may compare and discuss their homework solutions, but each solution has to be arrived at independently.

Exams: Two 70 minute mid-semester exams and one 120 minute final exam will be cumulative. No make-up exams will be administered for mid-semester exams. Students who miss a mid-semester exam for a valid reason will have the grading-point value of the final exam increased by 20 points. For the absence to be classified as having valid reason, students must notify the instructor about their absence before the exam and provide valid excuse (e.g. a doctor's note) that covers the exam day. The doctors note must be signed and contain legible name, hospital/office address and phone number and the reason for the absence. If the student disagrees with her/his score for the exam, she/he must request re-grading within one week from the day he/she received the graded exam. The exam questions may originate from end-of-chapter problems, homeworks, solved exercises from the textbook, problems solved during lecture&discussion (and their variations). Exams may also contain derivations or essays on topics presented during the lecture. Grading of all exams will include partial positive or negative credit for all significant steps taken to arrive to the final answer. Answers containing only the correct final answer without solution leading to this answer will receive a 50–80% grading penalty. Students must follow the seating assignments.

Class preparation: In order to understand the material presented during lectures and discussions, it is important to come to the class with good background knowledge. This can be achieved by reading (and thinking about) material in the textbook, reviewing appropriate material from calculus, physics and general chemistry classes, and solving end-of-chapter problems. Work together with your classmates; if you don't understand something, someone else may. You will also find that explaining a solution to your classmate will improve your understanding and long-term retention of the material. It is recommended that students devote to the preparation for this class a minimum of two hours every day.

Letter grades for the class will be calculated using both a fixed scale and a Gaussian scale. The scale that yields a better letter grade will determine your final letter grade.

Fixed scale
A = 100 – 82 grading points; A^- = 82 - 77; B^+ = 77 - 72; B = 72 - 67; B^- = 67 - 62; C^+= 62 - 57; C = 57 - 51; C^- = 51 - 46; D^+ = 46 - 42; D = 42 - 37; F = Less than 37 grading points.

Gaussian scale (M denotes a class average, and σ denotes standard deviation):

Earned Grading Points	Letter Grade	Earned Grading Points	Letter Grade
M – 0.2σ to M + 0.2σ	C+	M – 0.5σ to M – 0.2σ	C+
M + 0.2σ to M + 0.5σ	B-	M – 0.8σ to M – 0.5σ	C-
M + 0.5σ to M + 0.8σ	B	M – 1.1σ to M – 0.8σ	D+
M+ 0.8σ to M + 1.1σ	B+	M – 1.4σ to M – 1.1σ	D
M + 1.1σ to M + 1.4σ	A-	less than (M – 1.4σ)	F
More than (M + 1.4σ)	A		

Midterm grade: Your midterm grading points will be based on midterm exam(s) (80% weighting) and homeworks (20%).

Student Accommodations: The university provides services for students with disabilities. Any student who would like to use any of these university services should contact the Student Accessibility Center (SAC), Sullivan Center, (773) 508-3700 and let me know in the first week of classes.

Ethical Considerations: *Students will not collaborate on any exams. Only those materials and devices permitted by the instructor may be used to assist in examinations. Students will not represent the work of others as their own. Any student caught cheating during an exam will be reported to the Deans office and will receive zero points for the given exam. Materials from the course cannot be shared outside the course without the instructor's written permission.*

Tentative Schedule (exact exam dates and coverage will be announced in class and on Sakai) [%]

Week 1 Ch 2: The first law of thermodynamics, Heat capacity.
Week 2 Ch 2: State variables and state equations. Enthalpy, bond energies, molecular interpretations of enhalpy.
Week 3 Ch 3: The second law of thermodynamics, entropy.
Week 4 Ch 4: Gibbs and Hemholtz free energy. Noncovalent interactions.
Week 5 Ch 4: **Exam 1.** Free energy and chemical equilibria, biochemical applications of thermodynamics.
Week 6 Ch 4&9: Isothermal Titration calorimetry. Chemical kinetics – rates of chemical reactions and rate laws.
Week 7 Ch 9: **Mid-semester break.** Reaction mechanisms, transition-state theory. Electron transfer reactions.
Week 8 Ch 9&11: Very fast reactions. Foundations of quantum mechanics.
Week 9 Ch 11: Particle-in-a-box, harmonic oscillator, electronic structure of atoms.
Week 10 Ch 12: Biomolecular interactions. Molecular dynamics, computational chemistry.
Week 11 Ch 13: **Exam 2.** Electromagnetic spectrum, optical spectroscopy.
Week 12 Ch 13: Fluorescence and phosphorescence, infrared and Raman spectroscopy.
Week 14 Ch 13: Nuclear magnetic resonance, nuclear spin. **Thanksgiving break.**
Week 14 Ch 14: Chemical shift, spin-spin coupling.
Week 15 Ch 14: Relaxation mechanisms, multidimensional NMR spectroscopy.
Final Exam, Tuesday December 10, 1:00 – 3:00 PM, Cuneo Hall 109

[%] The instructor reserves the right to make changes to the schedule, except the date and time of the final exam. Any changes to other exam dates will be announced in class and on Sakai. There will be no make-up final exams given under any circumstance, and the exam will not be given early, either.