Syllabus

Physical Chemistry CHEM 4600 Spring 2021

DESCRIPTION

Last revised Jan. 30, 2021.

Course Description

A one-semester introduction to physical chemistry concepts and applications suitable for students pursuing biology- or health-related careers. Not recommended for students who intend to take graduate courses in chemistry or biochemistry. Assumes mastery of general chemistry (I and II), general physics (I and II), and calculus (I and II). Familiarity with multivariate calculus, analytical chemistry, and biochemistry is highly recommended. The course is fully online.

Learning Objectives

Upon completion of this course, students will acquire:

- The conceptual and quantitative understanding of chemical thermodynamics notions such as the enthalpy, entropy, and free energy of chemical reactions, and the chemical potential of substances and how these relate to chemical, biological, and life processes.
- The conceptual and quantitative understanding of notions of the kinetic theory of chemical reactions and how these are applied to the study of chemical and biological reactions.
- The conceptual, mathematical, and quantitative understanding of quantum mechanical theory and how it relates to the properties of molecules and their interactions, including notions and applications of molecular spectroscopy.

Course Instructor

Prof. Emilio Gallicchio (he/him/his)

- E-mail: egallicchio@brooklyn.cuny.edu
- Virtual Office Room: BlackBoard Ultra
- Cell: 646-552-7136
- Preferred mean of contact: E-mail

Office hours

- Mon 5:00 PM--6:00 PM
- Tue 5:30 PM--6:30 PM
- Thurs 11:00 AM--12:00 PM

Office hours are held in the instructor's office hour Blackboard Ultra meeting room.

Including the scheduled office hours above, I will try my best to hold 1 hour of office hours every day of the week, Monday to Friday, at times posted weekly on the Course Calendar. There will be a minimum of 3 hours of office hours weekly according to the schedule above. Changes in schedule will be announced. The Course Calendar will reflect the actual schedule of office hours scheduled for the week. Office hours sessions will follow a public forum format. Contact me directly by e-mail to make an appointment to discuss personal issues.

Textbook

The course loosely follows the textbook of Ira Levine: Physical Chemistry 6th edition. Lecture notes and additional reading material will be distributed during the course on this Blackboard site.

Required Items

- Reasonably fast access to the Internet to stream video (1 Mbit download or better).
- Non necessarily fast but stable Internet connection to take online exams.
- A desktop, laptop, or tablet to access the CUNY Blackboard and Blackboard Collaborate Ultra systems. A video camera and a microphone are recommended to interact with the class instructor.
- A valid e-mail registered with Blackboard.
- Texas Instruments calculator TI-30X or a similar inexpensive scientific calculator with equivalent features.

Grading

The course percent grade is calculated as a weighted average as follows:

- 30% Homework
- 20% First Midterm Exam
- 20% Second Midterm Exam
- 30% Final Exam

The course letter grade is assigned based on the percent course grade according to the following scale:

94% or higher: A+
93% to 87%: A
86% to 80%: A-
79% to 75%: B+
74% to 70%: B
69% to 65%: B-
64% to 60%: C+
59% to 55%: C
54% to 50%: C-
less than 50%: F

Online resources

- Course material, announcements, homework assignments, practice quizzes, exams, test grades and more will be distributed and administered via the Blackboard Course Site. Make sure to have a web browser compatible with Blackboard and Blackboard Collaborate Ultra.
- Students are encouraged to post and answer questions on the Course Discussion Board and discuss course topics with the instructor and fellow students.
- Students are expected and assumed to check the Blackboard class pages for changes and announcements at least daily

Course Schedule and Organization

The course consists of 12 learning modules. Each learning module has the following components:

- Lecture videos and lecture notes that can be followed asynchronously
- Reading assignments
- Short post-lecture self-assessment quizzes
- Interactive weekly meetings (recorded)
- Homework Assignments (graded)

The course also includes two Midterm Exams and a Final Exam (graded)

Study Guide

Learning physical chemistry requires a LOT OF WORK. Make sure you have enough study time to dedicate to this course. Pay particular attention to the material from lectures, lecture notes, examples, assignments, and practice quizzes. The textbook will be used mainly as a reference. Attempting to study the textbook cover-to-cover is unlikely to lead to success. The textbook is almost 1,000 pages long and it is dense with advanced math, chemistry, and physics. This course covers only a fraction of the topics in the textbook. In addition, the course emphasizes specific aspects of those topics that are covered. It is a bad idea to try to tackle this course on your own. Study in a group. Do not be left behind. Attend the lectures and stay on top of the assignments. If you can, read up on upcoming topics before they are presented in the lecture. Refresh your knowledge in general chemistry, physics, and especially math. Having to relearn background material while also studying for physical chemistry is not a good recipe for success. It is best to tackle this course with a mindset towards an in-depth scientific understanding of the material, rather than trying to memorize and second-guess what is going to be on the exams. You will do well on the exams if you can reach a real understanding of the concepts.

I am well aware of the difficulty of the material. At times the concepts presented in the lectures may feel somewhat abstract. However, assignments and exams will focus mainly on practical aspects and their level of difficulty is adjusted appropriately. Do the assigned work and we will get through this.

Lecture Videos and Reading Assignments

- For each week in which the course is in session, I will provide lecture videos and reading assignments for each module of the course.
- The lecture videos are meant to be watched and studied asynchronously *before* the corresponding interactive lecture/discussion session.

Self-assessment Quizzes

- Short self-assessment quizzes are provided with each module for you to probe your understanding of the topics presented in lectures and reading assignments.
- The self-assessment quizzes should be taken soon after watching the corresponding lecture video and before the corresponding interactive/discussion session.
- Self-assessment quizzes can be taken as many times as desired. They are one of the ways to get used to the format of the online exams.
- Questions pertaining to the self-assessment quizzes should be posted on the class Discussion Board. The grades on the self-assessment quizzes are placeholders only and are not included in the course percent grade. I use them only to track the completion of the quizzes to follow students' progress and engagement.

Interactive Weekly Meetings

- During the interactive sessions, I will mostly go over problems and discuss specific topics. I will include topics requested by you, the students, on the class Discussion Board. I will sometimes use this time to present particularly important new material that requires specific interactivity.
- Synchronous sessions will be held on Blackboard Collaborate Ultra at the official class times (generally on Mondays 2:15-3:45 PM)
- The times of two of the sessions will be also used to administering the midterm lecture exams (see below).
- See below and the Course Calendar for a detailed schedule of synchronous lecture sessions.
- I expect that students will join the synchronous lecture sessions after having completed the assignments specified for each session. The assignments include reading assignments, watching lecture videos, and completing the self-assessment quizzes.
- For the students unable to attend the synchronous sessions, I will do my best to record them and post the video soon after the end of the session. However, be mindful that technical difficulties with Blackboard beyond my control might prevent the acquisition of recordings. Do your best to attend the live synchronous sessions and take notes.

Exams

Exams will take place online on Blackboard according to the following schedule:

1. **FIRST MIDTERM EXAM**: Monday, March 15, 2021, 2:15 PM-3:45 PM on Blackboard
2. **SECOND MIDTERM EXAM**: Monday, April 26, 2021, 2:15 PM-3:45 PM on Blackboard
3. **FINAL EXAM**: Monday, May 24, 2021,1:00 PM-3:00 PM on Blackboard

No makeup exams are given for missed midterm tests. In case of a justified absence (i.e. a doctors' note), the grade on a missed midterm test will be calculated from the weighted average of the other midterm test and the final exam (with a 40% weight on the midterm and a 60% weight on the final).

The topics on the exams will follow closely those of the homework assignments.

Course Schedule

(tentative schedule subject to change)

Module	Topics	Interactive Session
1	General chemistry and math review	Mon, Feb 1
2	Principles of chemical thermodynamics (the first law)	Mon, Feb 8
3	Principles of chemical thermodynamics (the second law)	Mon, Feb. 22
4	Chemical equilibrium	Mon, Mar 1
5	Special topics: molecular binding, bioenergetics	Mon Mar 8
First Midterm Exam, Mon Mar 15, 2:15 PM, Covers Modules 1 to 5		
6	Reaction kinetics	Mon, Mar 22
7	Molecular transport and diffusion	Mon, Apr 5
8	Special topic: enzymatic kinetics	Mon, Apr 12
9	Principles of Quantum Mechanics	Mon, Apr 19
Second Midterm Exam, Mon Apr. 26, 2:15 PM. Covers Modules 6 to 9		
10	Spin and NMR spectroscopy	Mon, May 3
11	Angular momentum and the hydrogen atom	Mon, May 10
12	Chemical bonding	Mon, May 17
Final Exam, Mon May 24. 1:00-3:00 PM. Cumulative		

Homework Assignments

- There will be a total of 11 homework assignments
- Homework assignments are graded and generally consist of answering questions on Blackboard and uploading typed or legible hand-written work in pdf format before the due date.
- For numerical questions, grades will be assigned automatically based on the answers on Blackboard. I will randomly audit the uploaded work to check that it is consistent with the answers. Very substantial penalties will be imposed for missing, plagiarized, or otherwise inconsistent work.
- Grades for more complex homework problems will be assigned based on the uploaded materials (written work, graphs, spreadsheets, etc.).
- Penalties will be imposed on homework assignments submitted after the due date and will receive no credits after answer keys are released.
- Homework assignments are not exams. You are encouraged to work in groups, ask questions and discuss problems on the Discussion Board and during office hours, and access literature material. However, the submitted work has to be original. Very substantial penalties will be applied to copied work.
- Questions on the exams are for the most part taken from the homework assignments.
- Homework assignments are really central to this course. If you work on them diligently, you will earn grades and do well on the exams.

The tentative due dates of the homework assignments are as follows. Homeworks will be assigned at least one week before the due date.

Homework set	Topic	Interactive Session
1	Thermodynamics: first law	Mon, Feb 22
2	Thermodynamics: second law	Mon, Mar 1
3	Thermodynamics: chemical equilibrium	Mon, Mar 8
4	Thermodynamics: molecular binding and bioenergetics	Mon, Mar 15
5	Chemical kinetics: elementary reactions	Mon Apr 5
6	Chemical kinetics: complex reactions	Mon, Apr 12
7	Chemical kinetics: diffusion	Mon, Apr 19
8	Chemical kinetics: enzymatic kinetics	Mon, Apr 26
9	Quantum mechanics: complex numbers and linear algebra	Mon, May 3

10	Quantum mechanics: fundamental principles, spin	Mon, May 10
11	Quantum mechanics: atoms and chemical bonding	Mon, May 17

Academic Integrity

The faculty and administration of Brooklyn College support an environment free from cheating and plagiarism. Each student is responsible for being aware of what constitutes cheating and plagiarism and for avoiding both. The complete text of the CUNY Academic Integrity Policy and the Brooklyn College procedure for policy implementation can be found at www.brooklyn.cuny.edu/bc/policies. If a faculty member suspects a violation of academic integrity and, upon investigation, confirms that violation, or if the student admits the violation, the faculty member MUST report the violation. Students should be aware that faculty may use plagiarism detection software.

Disability Accommodations

In order to receive disability-related academic accommodations, students must first be registered with the Center for Student Disability Services. Students who have a documented disability or suspect they may have a disability are invited to set up an appointment with the Director of the Center for Student Disability Services, Ms. Valerie Stewart-Lovell at (718) 951-5538 or vstewart@brooklyn.cuny.edu. Once registered with the Center for Student Disability Services, please provide your professor with the course accommodation form and discuss your specific accommodation with him/her.

Student Bereavement Policy

Students who experience the death of a loved one during the semester may consult the College Student Bereavement Policy

Non-Attendance Due to Religious Beliefs

Students who are unable to attend class due to religious observations should consult the front matter of the Brooklyn College Undergraduate Bulletin for the college's policy which conforms to state law, and contact the lecturer to discuss the issue. Students must come forward with the issue in a timely manner.

Important Dates

- Friday, January 29: First day of Spring 2021 classes
- Thursday, February 4: Last day to add a course
- Monday, May 17: Last day to withdraw from a course with a "W" grade
- Tuesday, May 18: Reading Day
- Wednesday, May 19: Final Examinations Begin
- Tuesday, May 25: Final Examinations End / End of Spring Semester

The full academic calendar, including many other important dates, is available on the Office of the Registrar's website.

College Policies and Regulations

Students should read the "Academic Regulations and Procedures" in the Brooklyn College Undergraduate Bulletin or Graduate Bulletin for a complete listing of academic regulations of the College. These may be found on the Academic Calendars, Course Schedules, and Bulletins page of the Registrar's website.