

INTRODUCTION TO BIOPHYSICAL CHEMISTRY
CHEM 4150/6150 (13325/19141/13978; 3.0 credits)
Department of Chemistry, Georgia State University
2021 Spring semester

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Time and location: Tuesdays and Thursdays, 9:30 to 10:45 am via WebEx on iCollege. Each session is recorded and becomes automatically available to registered students on iCollege ~24 h after the lecture.

Office Hours: Email instructor for appointment

Prerequisite: Math 2212 or equivalent with grade of C or higher

Course Description:

A complete understanding of biological systems includes a quantitative description of the physicochemical properties that define their molecular structure and function. This course introduces students to how principles of physical chemistry apply to understanding biological systems and biotechnological advances in food science and pharmaceuticals.

Learning Outcomes:

Upon completion of this course, students will be able to:

1. Describe how physical chemistry governs the interactions of biological macromolecules with small molecules (including drugs and nutrients) and other macromolecules;
2. Articulate a physically intuitive view of biological systems at the molecular level;
3. Rationalize food science and pharmaceuticals principles in terms of fundamental chemistry;
4. Analyze and draw conclusions from experimental data.



Critical Thinking/Problem Solving

- recognize, build, and appraise arguments
- analyze visual data
- identify errors in reasoning
- provide useful summaries/precis
- connect valid research to support arguments/claims

Digital Technology

- know and apply field-related technology to solve challenges
- use variety of modalities to express meaning

Professionalism/Work Ethic

- demonstrates sensitivity to other's concerns
- accept responsibility
- ask and respond appropriately to questions
- meet deadlines
- demonstrate time management

Teamwork/Collaboration

- follow through on tasks
- prioritize tasks
- show commitment and follow through
- listen and respond appropriately

Recommended textbook

Atkins' Physical Chemistry by Atkins, de Paula, and Keeler, 11th edition (2018), Oxford University Press, Oxford, UK.

Course materials

Course content consists primarily of lecture slides, which will be supplied on iCollege, class discussions i.e. notes that you take in class, and problem sets (more below). They are supplemented by textbook reading as indicated in the course schedule on p.4.

Problem sets

A problem set will be provided approximately every two weeks. They are aimed at applying the concepts presented in class and **preparing you for the questions on the tests**. We will work on part of the problem sets during class; the rest is for you to complete outside of class. They will not be marked.

Policy regarding calculators

For problem solving, you will need a scientific calculator and learn how to use it. Any standalone scientific calculator will suffice; programming or graphing capabilities are not required, though permitted. If you would like suggestions, units such as the Casio *fx-260* or *fx-300* are reasonably equipped, widely available, easy to use, and inexpensive (<\$10).

Attendance and participation policy

You may access any of the WebEx lectures in the semester **asynchronously** once they become available on iCollege after the session. **However, attendance at the live WebEx sessions is highly recommended** as participants benefit significantly through real-time discussions and clarifications with the instructor as the material is presented.

Assessments

Assessment is based on four in-class tests, the last of which will be held during Finals week. The tests are weighted equally and not specifically cumulative in content. Tests are composed of a mixture of multiple choices and short written questions. Graduate students enrolled in CHEM 6150 will answer extra questions, which are optional (bonus) for undergraduate students, aimed at probing a more advanced level of understanding.

Grading Scale

Students can be assured of the following grades by attaining the indicated scores:

90%	A+	77%	B+	67%	C+	50%	D
85%	A	74%	B	64%	C	Below 50%	F
80%	A-	70%	B-	60%	C-		

The University requires that faculty members must, on a date after the midpoint of the course to be set by the Provost (or her designee) give a W to all students who are on their rolls but are no longer taking the class and report the last day the student attended or turned in an assignment.

Students who withdrawn may petition the Departmental Chair for reinstatement into their classes. **For the Spring 2021 semester, the semester midpoint is March 2, 2021.**

Make-up policy

Each assignment/exam will explicitly show its due date. Since there will be ample time to complete the work, you are expected to submit the work on time. If emergent circumstances arise that will cause excessive hardship in a timely submission, please notify the instructor at least 48 h prior to the due date. Any accommodation is strictly as agreed with the instructor and will be documented. Student requiring accommodation for disability should consult the statement of student support below.

Academic honesty

The Department of Chemistry follows the University policy on academic honesty published in the "Student Code of Conduct" (<https://codeofconduct.gsu.edu/>). All assignments and tests taken must represent the student's individual, unaided effort. Receiving or offering information on a test or assignment is cheating, including digital social media (including Facebook groups), as is the use of unauthorized supplementary materials or devices (see next section). **To receive credit, each assignment/exam must be accompanied by its coversheet, which the submitting student must sign to acknowledge that she/he understands the GSU policy on academic integrity and intends to follow it. Any suspected offense may be referred to the Dean of Students for further action.** The consequences of cheating are severe and potentially long-lasting: don't do it!

GSU policy prohibiting students from posting instructor-generated materials on external sites

The selling, sharing, publishing, presenting, or distributing of instructor-prepared course lecture notes, videos, audio recordings, or any other instructor-produced materials from any course for any commercial purpose is strictly prohibited unless explicit written permission is granted in advance by the course instructor. This includes posting any materials on websites such as Chegg, Course Hero, OneClass, Stuvia, StuDocu and other similar sites. Unauthorized sale or commercial distribution of such material is a violation of the instructor's intellectual property and the privacy rights of students attending the class, and is prohibited.

Statement of student support

The Americans with Disabilities Act (ADA) is a federal anti-discrimination statute that provides comprehensive civil rights protection for persons with disabilities. Among other things, this legislation requires that all students with disabilities be guaranteed a learning environment that provides for reasonable accommodation of their disabilities. Students who wish to request accommodation for a disability may do so via the Access and Accommodations Center (AACE) at <https://access.gsu.edu/>. Students may only be accommodated upon issuance of a signed Accommodation Plan by the AACE Center (see: <https://access.gsu.edu/testing-services/>) and are responsible for providing a copy of that plan to instructors of all classes in which accommodations are sought.

FERPA

In keeping with USG and university policy, this course will make every effort to maintain the privacy and accuracy of your personal information. Specifically, unless otherwise noted, it will not actively share personal information gathered from the site with anyone except university employees whose responsibilities require access to said records. However, some information collected from the site may be subject to the Georgia Open Records Act. This means that while we do not actively share information, in some cases we may be compelled by law to release information gathered from the site. Also, the site will be managed in compliance with the Family Educational Rights and Privacy Act (FERPA), which prohibits the release of education records without student permission.

Sexual harassment

In instances of sexual misconduct, the present instructor(s) and teaching assistants, are designated as Responsible Employees who are required to share with administrative officials all reports of sexual misconduct for university review. If you wish to disclose an incident of sexual misconduct confidentially, there are options on campus for you do so. For more information on this policy, please refer to the Sexual Misconduct Policy which is included in the Georgia State University Student Code of Conduct.

Basic needs statement

Any student who faces challenges securing their food or housing and believes this may affect their performance in the course is urged to contact the Dean of Students for support. Furthermore, please notify the professor if you are comfortable in doing so. This will enable us to provide resources that we may possess. The Embark program at GSU provides resources for students facing homelessness.

Course evaluation

Your constructive assessment of this course plays an indispensable role in shaping education at Georgia State. Upon completing the course, please take time to fill out the online course evaluation. Please note that the lecture and laboratory components are not evaluated together. The lecture component is evaluated on GoSolar. The laboratory component is evaluated separately by Qualtrics with links provided outside GoSolar.

Course Schedule

The course syllabus provides a general plan for the course; deviations may be necessary.

Week	Session	Date	Topic		Atkins/de Paula*		
1	1	1/12	Course orientation and Introduction	Conventions and measurements	Resource 2 and 3		
	2	1/14	Mathematics review	Algebra			
2	3	1/19		Differential calculus			
	4	1/21		Integral calculus			
3	5	1/26	Test 1 (Sessions 1 to 4)				
	6	1/28	Classical and statistical thermodynamics	Introduction	1		
4	7	2/2		Work and energy			
	8	2/4		Enthalpy			
5	9	2/9		Entropy and free energy	2		
	10	2/11		Introduction to statistical thermodynamics			
6	11	2/16		Chemical potential and equilibrium	4		
	12	2/18		Application of the equilibrium constant			
7	13	2/23	Test 2 (Sessions 6 to 12)				
	14	2/25	Physicochemical bases of biomolecular interactions	Noncovalent interactions: energetics and structure	11.5 – 11.10, 2.7		
8	15	3/2		Noncovalent interactions in biology		11.11 – 11.16, 3.5	
	16	3/4					
9	17	3/9					
	18	3/11					
Spring break		3/16					
		3/18					
10	19	3/23	Test 3 (Sessions 14 to 19)				
	20	3/25	Biotech applications of biophysical chemistry	Microbiological and pharmaceutical review	F.1		
11	21	3/30					
	22	4/1					
12	23	4/6				Sterilization and food preservation	6
	24	4/8					
13	25	4/13					
	26	4/15	High pressure in biotechnology	3			
14	27	4/20					
	28	4/22	Test 4 (Sessions 21 to 27)				