

CHEMISTRY 330 / F22

Physical Chemistry

Prof. Andrew J. Pounds, Ph.D.

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Office Meeting: MW 12:15-1:00 p.m., F 10:15-11:00 a.m., or arranged via ZOOM

*“During recent years it has come to be more widely recognized in our Universities and Colleges that the course of study for students of Chemistry, no matter what special branch of the subject they may intend to devote themselves later, cannot be regarded as complete or satisfactory unless it include both systematic and practical Physical Chemistry.”*¹

CHM 330 is a course to help students understand the underlying physics of chemical systems. CHM 330 introduces thermodynamic laws, their relationship to statistical mechanics, and how these together can be used to express and predict the equilibrium state of a chemical system. Kinetics and transport processes are then presented as ways to describe how systems approach the equilibrium state. Students will also be introduced to the mathematical treatment of atomic and molecular structure via quantum mechanics and the strong relationships between structure and spectroscopy. Students are expected to already have a foundation in chemistry (CHM 111/112), as well as single variable differential and integral calculus (MAT 191/192). Upon completion of this course, a student will demonstrate competence in each of the following areas:

- utilizing physical reasoning to derive and solve mathematical representations of chemical phenomena,
- utilizing available resources and tools to understand and solve physical chemistry problems,
- understanding chemical concepts from the lecture by successfully applying these concepts on homework and tests.

Class Meeting Times and Locations

Lecture: MWF 11:15 a.m. - 12:05 p.m., GSC 102

Course Materials

Physical Chemistry: Principles and Applications in Biological Sciences, Tinoco, *et al.*, 5th ed.,
Mastering Chemistry online homework key
Scientific Calculator

Course Structure

Portions from 11 chapters of the text will be covered during the semester. Additional mathematical and supporting material will be provided by the instructor as applicable. The lecture time will be used to expound on and augment the texts, discuss problem solving strategies, and to learn how to effectively utilize the provided computational tools. Students are responsible for all material covered in class, material from the textual sections denoted by the instructor and other materials as indicated by the instructor. Exams will consist of four in-class 50 minute exams and a final exam. There will be regularly assigned online homework and four self-guided capsules.

¹Alex Findlay. *Practical Physical Chemistry*, 1906

Grading

Exams	40%
Online Homework	25%
Capsules	25%
Final Exam	10%

Total Possible	100%

Course Grade Scale

A	≥900 pts	This grade scale is assured but <i>may</i> be lowered <i>slightly</i> based on test results.
B+	≥880 pts	
B	≥800 pts	
C+	≥780 pts	
C	≥700 pts	
D	≥600 pts	
F	<600 pts	

Honor Code: All students in CHM 330 are expected to adhere to the Mercer University Honor Code. Any suspected violations will be reported to the Honor Council for further investigation.

Attendance: Attendance will be taken the first 10 class periods. Attendance will not be taken after that date. Students are expected to be in class and are accountable for all material covered in class as well as any announcements made during the lecture period. If you know that you are going to miss class, please send me a text or e-mail to let me know about your absence.

Missed Exams: Anyone missing an exam for *any* reason (personal illness, death in the immediate family, or other emergency) must notify Dr. Pounds in advance. The absence will be considered unexcused otherwise. Make-up exams will be individually scheduled.

Weighted Exam Grades: The lowest test grade of the 50 minute in-class exams will be multiplied by 0.5 and the highest test grade of the 50 minute in-class exams be multiplied by 1.5 in the final class average.

Partial Credit: Partial credit will not be awarded on any exam or homework unless individuals show their work and clearly delineate how they arrived at their answers.

Re-grading Policy: If a student suspects that an error was made in the grading of a submitted work, they may return the paper for re-grading with the understanding that the entire work will be re-graded and not only the portion in question.

Homework: Students are encouraged to work together on homework assignments. Each person, however, must turn in their own assignments in their own words.

Capsules: There will be four independent study Capsules submitted for grading. These capsules will deal with using computational tools for modeling chemical processes. The dates for each of the capsules will be determined when they are assigned. The materials for the capsules will be submitted via *CANVAS*.

Online Homework: Several problems from each chapter will be assigned in the *Mastering Chemistry* online homework system. Students will be electronically notified of the due date for each of these assignments.

Electronic Submission of Materials: "Students bear sole responsibility for ensuring that papers or assignments submitted electronically to a professor are received in a timely manner and in the electronic format(s) specified by the professor. Students are therefore obliged to have their e-mail client issue a receipt verifying that the document has been received. Students are also strongly advised to retain a copy of the dated submission on a separate disk. Faculty members are encouraged, but not required, to acknowledge receipt of the assignment."

Class Web Page: I maintain a web page for the class outside of the University *CANVAS* system which I regularly update with material for the class. The address is <http://theochem.mercer.edu/chm330>. I will notify the class whenever changes are made to this web page.

E-mail Listserve: I communicate heavily with the class (and encourage you to do the same) via an e-mail listserv which I maintain myself. Please subscribe to the listserv by going to

<http://theochem.mercer.edu/mailman/listinfo/chm330>

and filling out the required fields. Once subscribed, you may send e-mail to the class by using the e-mail address chm330@theochem.mercer.edu I personally moderate all requests to limit e-mail spam.

Course Evaluations: In an ongoing effort to improve the quality of instruction, each student enrolled in this course is required to complete an end-of-semester course evaluation. Details about the evaluation process will be provided at the end of the term.

Final Exam: The final exam is scheduled for Thursday, December 15th at 9 a.m.

University Compliance Statements

Accommodations and ADA/504: “Students in need of accommodation due to a disability should contact the Access and Accommodation Office to complete the verification process to become approved for services. In order to receive accommodations, each term, students will request accommodation and faculty notification forms through the Access Office online system Accommodate. Students are strongly encouraged to schedule a meeting with each professor in a timely manner to discuss arrangements. Accommodations are not retroactive in nature. Note - Disability accommodations or status are not reflected on academic transcripts. Students with a history of a disability, perceived as having a disability or with a current disability who do not wish to use academic accommodations are also strongly encouraged to complete the verification process with the Access Office. Students must request accommodations in a timely manner to receive accommodations in a timely manner.

The Access Coordinator for Macon Campus is

Katie Johnson, Director and ADA/504 Coordinator.
Phone: (478) 301-2778; email: johnson_kc@mercer.edu
Website:
<https://access.mercer.edu>

Please note the following additional information from the Access and Accommodation Office (AAO):

In compliance with Section 504 of the Rehabilitation Act of 1973 (504) and the Americans with Disabilities Act Amendments Act of 2009 (ADAAA), “otherwise qualified” students with disabilities are protected from discrimination and may be entitled to “reasonable accommodations” intended to ensure equal access to all courses, programs, and services without a change of curriculum. Examples of accommodations include but are not limited to: testing accommodations, providing alternative format textbooks and tests, note-taking support, and modifications of policies or procedures. Equal Access may require moving a class or event to a physically accessible room, making websites accessible to screen readers, providing sign language interpreters, and captioning videos. All students requesting to be recognized as a student with a disability or requiring accommodations must first self-identify by requesting accommodations with the designated Access Coordinator for their campus or program and complete the verification process.”

Mental Health and Wellness: “Mercer University faculty and staff recognize that mental health concerns can impact academic performance and interfere with daily life activities. Because stress is a normal part of the college experience, learning to manage stress effectively is crucial to your well-being and overall success. Please notify your faculty member or academic advisor for academic assistance, as needed. CAPS can also provide support if you are feeling anxious, overwhelmed, depressed, lost or are struggling with personal issues. Please call or visit the Counseling and Psychological Services (CAPS) website at <https://counseling.mercer.edu/> for more information. These services are free and confidential, and support non-traditional, graduate, and undergraduate students. Students may access CAPS at the location of their academic program: MACON – Counseling Center (formerly the Honors House), 478-301-2862; ATLANTA – 215 Sheffield Student Center, 678-547-6060. Students at Regional Academic Center and other locations may obtain assistance in finding local services by contacting the CAPS Office nearest them. We also encourage students to call or text 988 to reach the National Suicide & Crisis Line if needed.”

Electronic Submission of Materials: “Students bear sole responsibility for ensuring that papers or assignments submitted electronically to a professor are received in a timely manner and in the electronic format(s) specified by the professor. Students are therefore obliged to have their e-mail client issue a receipt verifying that the document has been received. Students are also strongly advised to retain a copy of the dated submission on a separate disk. Faculty members are encouraged, but not required, to acknowledge receipt of the assignment.”

Cell Phones and Pagers: “Out of courtesy for all those participating in the learning experience, all cell phones and pagers must be turned off, or placed on vibrate, before entering any classroom, lab, or formal academic or performance event.”

FERPA and Assessment: The College of Liberal Arts is keenly interested in assuring the quality and integrity of its general education program. Every semester, randomly selected samples of student work from general education courses will be independently and objectively assessed. No personally identifiable information about any student will be used for the purposes of this assessment, and assessment results will have no bearing whatsoever on student grades.

Tentative Class Schedule¹

Week Starting	Chapter Sections	Lecture and Problem Solving Topics
August 21 st	Chapter 2	Introductions / Course Materials and Structure The First Law State Variables vs. Path Variables Energy Exchange, Enthalpy, Phase Changes
August 28 th	Chapter 3	The Second Law Entropy, Carnot Cycles Third Law, Gibbs and Helmholtz Free Energies Maxwell's Relations
September 4 th	Chapter 4	9/5 Labor Day Holiday (Monday) Free Energy and Equilibrium
September 11 th		Chemical Potential, Activity Coefficients Ideal and Non-Ideal Systems
September 18 th	Chapter 5	Statistical Thermodynamics EXAM ONE, 9/21/22 The Maxwell and Boltzmann Distributions The Random Walk, Model Systems
September 25 th	Chapter 6	Physical Equilibria Phase Equilibria Colligative Properties Membranes, Transport, and Tension
October 2 nd	Chapter 8	Motions of Biological Molecules Collisions, Diffusion, Friction
October 9 th	Chapter 9	Kinetics: Rates of Chemical Reactions Rate Laws, Reaction Mechanisms Temperature Dependence, Transition State Theory
October 16 th		EXAM TWO, 10/17/22 FALL BREAK 10/20-10/21
October 23 rd		The Steady State Approximation Marcus Theory, Diffusion Controlled Reactions LAST DAY FOR COURSE WITHDRAWAL 10/28/22
October 30 th	Chapter 10	Enzyme Kinetics Michaelis-Menten Kinetics Competition and Inhibition
November 6 th	Chapter 11	Atomic Structure and Quantum Theory Wave Mechanics EXAM THREE, 11/11/22
November 13 th		The Schrödinger Equation Model Potentials, Electron Distributions, and the Hydrogen Atom Postulates and Approximations
November 20 th	Chapter 12	Molecular Structure and Bonding, Molecular Orbitals Intermolecular Forces THANKSGIVING BREAK, 11/23-11/25
November 27 th	Chapter 13	Atomic and Molecular Simulation Optical Spectroscopy Absorption and Emission of Radiation EXAM FOUR, 12/2/22
December 4 th		Fluorescence / Vibrational Spectroscopy
December 11 th		FINAL EXAM, 12/15/22, 9 a.m., (Thursday)

¹ I reserve the right to modify this schedule as situations warrant.



University Health and Safety Protocols for the Fall 2022 Semester Syllabus Statement for All Students

Office of the Provost 478-301-2110

Campus Health's COVID-19 Hotline 478-301-7425

In order to promote safe campuses, students are required to follow these COVID-19 protocols:

- Check the University [COVID-19 website](#) and your Mercer email for important updates and messages.
- Masks are not required on campus, except at the Campus Health Centers on the Macon and Atlanta campuses. Of course, anyone who chooses to wear a mask on campus for their own protection is welcome to do so. Faculty may require masks when meeting in their individual offices with students, colleagues, or guests. Health science students and employees may be required to wear masks in clinical settings.
- **If you are symptomatic of COVID-19, regardless of vaccination status, you cannot attend** in-person classes, labs, orientations, clinical/field experiences, other on-campus activities, or employment on campus. You should immediately call Campus Health's COVID-19 Hotline at (478) 301-7425 for a testing appointment during regular business hours or get tested immediately at an off-campus location. If symptomatic and tested off campus, please call to inform Mercer Medicine at (478)-301-7425.
- If you are asymptomatic (showing no symptoms) and would like to get tested, go to go.mercer.edu/covidappt to schedule an appointment at the Macon or Atlanta Campus Health Center.

There have been changes to insurance coverage for COVID-19 testing. As a result, Mercer Medicine will bill your insurance company for COVID-19 testing if you are symptomatic or have been exposed recently to someone who has tested positive for COVID-19. The University covers the costs of COVID-19 testing for Mercer on Mission, Study Abroad, and other University-related international travel programs. If you are tested for other reasons, you will be required to pay \$90 at the time of testing.

- Testing locations:
 - Macon – Campus Health Center, Drake Field House, Macon Campus
 - Atlanta – Campus Health Center, Sheffield Building, Atlanta Campus
 - Savannah – Memorial University Medical Center, Savannah Campus (Dr. Kirkpatrick)
 - Columbus – Mercer University School of Medicine, Columbus Campus (Dr. House)
- Mercer Medicine accepts off-campus PCR test results and **positive** antigen test (known as rapid test) results from reputable testing facilities.

Mercer Medicine does NOT accept

- negative antigen test (called rapid test) results;
 - home/self test results; and
 - antibody test results.
- All students must submit **off-campus, positive COVID-19 results** immediately to Campus Health at mytestreport@mercer.edu. In the subject line of the email, type "Macon Test" (for Macon, Savannah, and

Columbus students) or type “Atlanta Test” (for Atlanta, Henry, and Douglas students). Be sure to include your full legal name and Mercer ID in the body of the email.

Off-campus positive results must be submitted to Campus Health as soon as you receive them. If you fail to submit your results in a timely manner, excused absences and academic accommodations will not be provided beyond the five days after testing.

- If you test at the Campus Health Center and test **positive**, a Campus Health staff member will call you from a Mercer phone number with the positive result. With a **negative** result, you will receive an email in your Mercer email account.
- Do not submit COVID-19 results directly to faculty, the Dean’s Office, or Student Affairs for COVID-related, excused absences. All COVID-related absences must be processed through Campus Health and the Office of the Provost. Faculty are then notified of a student’s COVID-related, excused absence(s).
- Faculty are required to provide academic accommodations to students who are in isolation after either testing positive at the Campus Health Center or submitting off-campus, positive test results to Campus Health at mytestreport@mercer.edu.
- If you **are symptomatic and awaiting test results**, you must isolate and be provided academic accommodations during this brief isolation period. If you tested on campus, faculty will be notified. If you are symptomatic, tested off campus, and are awaiting results, contact Campus Health immediately at 478-301-7425 so that faculty can be notified. If you do not receive your results within two (2) business days, contact Campus Health at 478-301-7425 for a testing appointment on campus.
- The isolation period for COVID-19 has been reduced to **five days**. While in isolation, you must complete your daily **Bear Check** as a way for Mercer Medicine to monitor your symptoms. The Bear Check is located in MyMercer > Dashboard > Action Items.

You must remain in isolation until you are cleared by Mercer Medicine.

- **Residential students** who test positive have these isolation options:
 - Recover at home, if possible.
 - Isolate in place in your own room. Isolating in place means that you stay in your current residence, distance yourself from roommates/suitemates as much as possible, and wear a mask inside the residence as often as possible. Roommates/suitemates should also wear masks inside the residence as often as possible.

You may leave your assigned room, while wearing a mask, **only** to seek medical care and pick up to-go or delivery meal options to eat in your room. For students on the Macon campus, Aramark provides to-go meals.

Contact the Office of Housing and Residential Life with questions or concerns:

Macon: (478) 301-2687

Atlanta: (678) 547-6104