UNIVERSITY OF GEORGIA

CHEM 3212 Physical Chemistry II
Spring 2026

Instructor: Professor Brandon Rotavera
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Topical Outline: The Properties of Gases;
The Boltzmann Factor and Partition Functions;
Quantum Mechanics: The Basics;
Quantum Mechanics: Model Systems;
Partition Functions of Model Systems;
Energy and Enthalpy;
Entropy;
Gibbs and Helmholtz Energies;
Chemical Kinetics;
Reaction Mechanisms;
Transition State Theory;

Description: Equations of state and physics of gases, Boltzmann statistics, partition functions, quantum mechanics of model systems, and thermodynamics topics including internal energy, enthalpy, and entropy of molecular systems, Gibbs and Helmholtz energies. Introductory chemical kinetics, transition state theory, and analysis of reaction mechanisms. Emphasis is placed on chemically reacting systems including combustion and atmospheric chemistry.

Credit Hours: 3 (lecture)

Prerequisites: CHEM 3211
MATH 2270 or MATH 2500 (pre- or co-requisite)

Lecture Times: Tuesday/Thursday 9:55 – 11:15 A

Lecture Location: STEM-I, Room 1023

Website: eLC

Required Text: *Physical Chemistry, 10th or 11th edition*
Author: Peter Atkins and Julio de Paula

Grading:	Exam 1	35%
	Exam 2	35%
	Quizzes (4 – 6)	30% (based on top three scores)

The overall grade is based on two topical exams and 4 – 6 quizzes. The grading scale is based on the following ranges: A = 90 – 100%, B = 80 – 89%, C = 70 – 79%, etc. Pluses and minuses (+ / –) are given with discretion.

Departmental Grading Policy Regarding Communication Skills: 30% of the grade on all written assignments is based on the quality of communication. In the context of exams and homework there are several key aspects that define quality, including clear organization of the solution procedure, written interpretation of assumptions used for a particular problem, and commentary as to the implications of the numerical result and/or connection to the assumptions.

Homework: Working homework problems is a necessity for practicing and learning the material, and is a tool that leads to developing a deeper understanding beyond the lecture content. Homework is assigned on an approximately bi-weekly basis (approximately 5 – 8 problems) but will not be collected or graded for a homework grade. Discussion of the solutions to selected problems will take place in lecture, time permitting, or during problem-solving sessions. Diligently working through the assignments and presenting the results in an organized, professional format is strongly encouraged. Of particular importance is the rigor of the methodology applied (i.e. application of assumptions, equations), organizational merits, reaching the correct solution, analysis and interpretation of the result(s), as an important component of the solution is also writing comments on the context/meaning of the result.

Academic Honesty: Ethical behavior and academic honesty are expected and required of students and even more so of engineers and scientists. Evidence of cheating during an exam or other assignment for credit may result in failure of the entire course for the student(s) in question. The University of Georgia requires academic honesty and personal integrity among students and other members of the University Community. A policy on academic honesty has been developed to serve these goals. All members of the academic community are responsible for knowing the policy and procedures on academic honesty. The document for academic honesty may be found at the website for The University of Georgia Office of Senior Vice President for Academic Affairs and Provost. All academic work must meet the standards contained in "A Culture of Honesty". Students are responsible for informing themselves about the standards before performing any academic work.

Americans with Disabilities Act (ADA) Policy Statement:
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. If you believe you have a disability requiring an accommodation, please contact Disability Resource Center, in Clark Howell Hall, call 706-542-8719, or email at dsinfo@uga.edu. For additional information visit drc.uga.edu.

Course Objectives and Expected Learning Outcomes: By the end of the course, students will have, at a minimum, developed the ability to (a) understand and explain conceptual underpinnings of equations of state for gases including ideal gas and van der Waals, (b) mathematical constructs for Boltzmann statistics, partition functions, and basic quantum mechanics equations, (c) employ quantum mechanics principles and equations to predict behavior of model systems, including particle-in-a-box, (d) apply thermodynamics analysis for calculating changes in internal energy, enthalpy, entropy, Gibbs and Helmholtz energies of molecular systems, (e) apply integrated rate laws to calculate rates of chemical reactions in combustion and atmospheric chemistry, and (f) understand basics of transition state theory.

Course Schedule (Table 1): The exam dates are subject to change upon prior notice with at least one week in advance.

Table 1. Course schedule: January 12 – April 30, 2025.

Week	*Tuesday*	*Thursday*	*Notes*
1	1/13	1/15	
2	1/20	1/21	
3	1/27	1/29	
4	2/3	2/5	
5	2/10	2/12	
6	2/17	2/19	
7	2/24	2/26	
8	3/3	3/5	**Exam 1, 3/5**
9	3/10	3/12	**Spring Break**
10	*3/17*	3/19	no class on 3/17 (conference travel)
11	3/24	3/26	
12	3/31	4/2	
13	4/7	4/9	
14	4/14	4/16	
15	4/21	4/23	
16	4/28	4/30	**Exam 2, 4/30, 8 – 11 A**