

CHM 431
Physical Chemistry I
Fall 2025 Course Syllabus

Instructor:

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Scheduling:

MWF, 9-9:50am in Beaupre 105

Co-/Prerequisites:

CHM 192 or 112, MTH 142, PHY 112 or 204

Required texts:

Thermodynamics, Statistical Thermodynamics and Kinetics (Fourth Edition) by Thomas Engel and Philip Reid, Pearson, 2019

Office hours:

M 10-11am W 10am-12pm

If my regular office hours do not fit your schedule, you are welcome to email me to arrange an appointment at another time. I typically respond within 24 hours.

The CHM 431 Brightspace page:

1. All written materials, including the syllabus, problem sets, and problem set solutions etc. will be posted to the CHM 431 Brightspace page.
2. A discussion forum will be available for submitting questions. Posts may be submitted anonymously to classmates, though the instructor will be able to view the author's name.

Overview:

Physical chemistry focuses on applying the principles of physics to chemical reactions and to the properties and transformations of matter, examined using mathematical tools. The four core

branches of physical chemistry are thermodynamics, kinetics, quantum mechanics, and statistical mechanics.

In this course, we will study thermodynamics, which addresses the *macroscopic* behavior of chemical systems. Kinetics, which explores reaction mechanisms and rates, and quantum mechanics, which investigates molecular structure and interactions, will be introduced in CHM432. Statistical mechanics, which provides a statistical framework connecting *microscopic* molecular behavior to macroscopic thermodynamic properties, is typically covered in graduate-level courses.

In the first half of the semester, we will focus on the three laws of thermodynamics and their application to chemical systems. These laws provide the framework to rationalize equilibrium phenomena, including both phase equilibria and chemical equilibria. Developing a clear understanding of the thermodynamic basis of equilibrium is a central objective of this portion of the course. In the second half of the semester, we will extend these concepts to more complex and realistic systems, such as real solutions and electrochemical cells.

Grades:

You may choose one of the two options below for how your final grade will be calculated. Please email me your decision before the next class (09/05 9am).

Option A

- | | |
|-----------------------|-----|
| · Four one-hour exams | 67% |
| · Final exam | 33% |

Option B

- | | |
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| · Problem sets | 40% |
| · Four one-hour exams
(drop the lowest grade) | 30% |
| · Final exam | 30% |

If you must miss an exam for religious observance or a university-sanction event, please notify me as soon as possible (e.g., **within the first week of class**). For unplanned by **excused absences** (see below), reach out to me directly by email to discuss options for making up an exam. If classes are canceled on an exam date (e.g., due to weather), the exam will be given on the next date the class meets.

Material covered (dates subject to change):

09/03 – 09/08	Chapter 1	Fundamental Concepts of Thermodynamics
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09/10 – 09/17	Chapter 2	Heat, Work, Internal Energy, Enthalpy, and the 1 st Law
09/19 – 09/24	Chapter 3	State Functions: Internal Energy and Enthalpy
09/26 – 10/03	Chapter 4	Thermochemistry
10/06 – 10/13	Chapter 5	Entropy and the 2 nd and 3 rd Laws
10/15 – 10/22	Chapter 6	Chemical Equilibrium
10/24 – 10/27	Chapter 7	The Properties of Real Gases
10/29 – 11/05	Chapter 8	Phase Diagrams
11/07 – 11/19	Chapter 9	Ideal and Real Solutions
11/21 – 12/01	Chapter 10	Electrolyte Solutions
12/03 – 12/08	Chapter 11	Electrochemical Cells, Batteries, and Fuel Cells

Important dates:

09/03	First class
09/25	Last day for dropping without a “W”
10/03	Exam 1
10/13	No class (Indigenous Peoples’ Day)
10/15	Last day to drop classes
11/03	Exam 2
11/21	Exam 3
11/26, 11/28	No class (Thanksgiving recess)
12/08	Exam 4 and Last class
12/12*	Final Exam, 8-10am

*Check online for date/time change

Viral Illness Precautions Statement

The University is committed to delivering its educational mission while protecting the health and safety of our community. Students who are experiencing symptoms of viral illness should NOT go to class/work. The [Centers for Disease Control and Prevention \(CDC\)](#) recommends that all people who are experiencing viral illness should stay home and away from others until symptoms improve and they are fever free (without medications) for 24 hours. They should take added precautions for the next 5 days. If you are unable to attend class, please notify me prior to the start of class by emailing me (zhen.tao@uri.edu).

Excused Absences

Absences due to serious illness or traumatic loss, religious observances, military service, or participation in a university sanctioned event are considered excused absences. Students are responsible for work missed during an excused absence but will not be penalized by grading or

assignment/exam make-up policies. Students should notify faculty in advance of absences due to religious observance or university-sanction events, and as soon as possible for other absences. See [University Manual sections 8.51.11-8.51.16](#) for details.

Anti-Bias Syllabus Statement

We respect the rights and dignity of each individual and group. We reject prejudice and intolerance, and we work to understand differences. We believe that equity and inclusion are critical components for campus community members to thrive. If you are a target or a witness of a bias incident, you are encouraged to submit a report to the URI Bias Resource Team at www.uri.edu/brt. There you will also find people and resources to help.

Disability, Access, and Inclusion Services for Students Statement

Your access in this course is important. Please send me your Disability, Access, and Inclusion (DAI) accommodation letter early in the semester so that we have adequate time to discuss and arrange your approved academic accommodations. If you have not yet established services through DAI, please contact them to engage in a confidential conversation about the process for requesting reasonable accommodations in the classroom. DAI can be reached by calling: 401-874-2098, visiting: web.uri.edu/disability, or emailing: dai@uri.edu.

Anti-Discrimination Resources

Several offices provide support to help faculty comply with the University's commitment to maintain an educational and working environment free from discrimination, and to uphold our collective obligation as a community to foster an inclusive, people-centered culture.

Office of Equal Opportunity (OEO)

The [Office of Equal Opportunity](#) (OEO) leads institutional civil rights compliance efforts and supports the belief that all individuals have a right to enjoy equal opportunity in employment and equal access to all university programs, services, and activities, without regard to their protected status. OEO's primary focus areas include: anti-discrimination, affirmative action, equal opportunity, Americans with Disabilities Act (ADA) and Rehabilitation Act Compliance, education & training, and language access. OEO is available to address inquiries from faculty, staff, students, and service recipients and to work with departments to promote compliance with the university's Policy on Nondiscrimination, Policy on Language Access, the University's Language Access Plan, and applicable civil rights laws and regulations.

Title IX.

Any student, faculty, or staff member with questions or concerns about the Policy on Sexual Misconduct or who believes that they have been the victim of sex discrimination, sexual harassment, or sexual violence, as defined under Title IX, is encouraged to contact the University's Title IX Coordinator. Matters involving employees that do not meet the burden of proof under Title IX are forwarded to the Office of Equal Opportunity and the Office of Human Resources. The Title IX Office, in collaboration with the Dean of Students, provides support for and ensures enforcement of the University's Policy on Sexual Misconduct. The Title IX Coordinator also provides support to pregnant and parenting students, in collaboration with the Dean of Students, and to pregnant and parenting employees, in collaboration with the Office of Human Resources. Faculty with questions or concerns about potential sex-based discrimination or sex-based harassment violations, or departments seeking training, should contact the Title IX Coordinator at tixc@etal.uri.edu. More information is available at: [Know your Title IX – Sexual Violence Prevention and Response](#).

Providing equal access for students with disabilities

Every qualified student with a disability has the right to equal access to educational programs, services, activities, and facilities. Documentation-supported accommodations are communicated to faculty through a letter from Disability, Access and Inclusion (DAI), delivered by the student. Faculty are required by law to provide these accommodations and are encouraged to review the information on the [DAI website](#). The [Academic Testing Center](#) is available to support testing accommodation needs. Students seeking accommodations in their roles as internal payroll employees should contact the Office of Human Resources. This includes Graduate Assistants and Graduate Research Assistants. Students seeking accommodations in their roles as Federal Work-Study recipients should contact the Office of Human Resources and their placement supervisor. Testing accommodations are administered by the Academic Testing Center and must be coordinated by the faculty. Visit [ADA Compliance – Office of Equal Opportunity](#) for a list of ADA Liaisons at the University of Rhode Island.

Disability, Access, and Inclusion Drop-In Hours

Questions about student DAI accommodations? DAI staff are available each weekday from 2-4pm in their [webex room](#), or call 874-2098. DAI leadership also provides special Faculty WebEx Drop-in Hours, for the first month of the Fall and Spring semesters on Mondays from 11AM-1PM and Wednesdays from 8-10AM. Please also reach out to us at dai@uri.edu if you would like to discuss a Workshop for your department or colleagues, we can work with you to tailor this to your individual needs and interests.

Academic Honesty

Students are expected to be honest in all academic work. A student's name on any written work, quiz or exam shall be regarded as assurance that the work is the result of the student's own independent thought and study. Work should be stated in the student's own words, and properly attributed to its source. Students have an obligation to know how to quote, paraphrase, summarize, cite and reference the work of others with integrity. Instructors shall have the responsibility of informing students about their expectations regarding the preparation of all assignments with academic integrity...[and] shall have the explicit duty to take action in known cases of cheating or plagiarism.

Land Acknowledgement

The University of Rhode Island land acknowledgment is a statement written by members of the University community in close partnership with members of the Narragansett Tribe. The statement recognizes and pays tribute to the people who lived on and stewarded the land on which the University now resides. The statement seeks to show gratitude and respect to Indigenous people and cultures and build community with the Narragansett Nation and other Native American tribes.

University of Rhode Island Land Acknowledgment

The University of Rhode Island occupies the traditional stomping ground of the Narragansett Nation and the Niantic People. We honor and respect the enduring and continuing relationship between the Indigenous people and this land by teaching and learning more about their history and present-day communities, and by becoming stewards of the land we, too, inhabit.

Mental Health and Wellness

We understand that college comes with challenges and stress associated with your courses, job/family responsibilities and personal life. URI offers students a range of services to support your [mental health and wellbeing](#), including the [URI Counseling Center](#), [TELUS Health Student Support App](#), the [Wellness Resource Center](#), and [Well-being Coaching](#).