

CHEM 3602: Physical Chemistry Preparation

Credit Hours: 1

Meeting Time: M 2:20-3:10 PM

Classroom: Old Mill Annex A304

Instructor: James Zahardis, PhD

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Office: Innovation E329

Office Hours: TWR 12:00-2:00 p.m.

Textbook (recommended): Physical Chemistry A Molecular Approach by Donald A. McQuarrie and John D. Simons, University Science Books

ISBN-13: 978-0935702996

Co- and Pre-requisites

Pre-requisite: CHEM 1450 (Gen Chem 2) or CHEM 1455 or CHEM 1460 (Exploring Chemistry 2) and MATH 1246 (Calculus II)

Course Description

The goal of this course is to develop mathematics skills needed for success in CHEM 3600 (Advanced Physical Chemistry), with emphasis on select material from Calculus III (MATH 2248) as well as specific skills derived from Ordinary Differential Equations and Probability and Statistics.

Course Modality

This is an in-person course. The lectures will not be recorded. If you miss class due to an excused absence, please contact me so we can discuss mitigation strategies.

Grading

This course will be based on graded homework sets that will be assigned on a weekly or every two weeks basis. These homework sets will include problems that both develop foundational math skills as well as those that apply them to physical chemistry. (For example, part 1 of a problem may involve taking partial derivatives of a multivariable function, $f(x, y, z)$, with the second part of the problem using that skill to derive thermodynamic relationships by partial differentiation of a thermodynamic property, such as pressure, P , which is expressed as a multivariable function, i.e., $P(V, n, T)$.)

Grading Criteria/Policies

Grade components: I will grade homework assignments based on your ability to solve problems, so showing all work is essential. Specific restrictions on assignments or exams will be provided at the time this material is distributed.

Late policy: Graded assignments that are turned in late are subject to a loss of points, which will be detailed when the assignment is distributed.

Grading scheme: I will apply the standard grading scale but reserve the right to rescale the grades at the end of the course.

Assessments (Graded Work)

I will grade the assignments based on your ability to solve problems and to receive full credit all work must be shown. This is a skill-building class for physical chemistry; therefore, on many of the straightforward problems I will specify that I want the problems solved by hand (i.e., not using MATLAB, Mathematica or other software). Conversely, on other problems I will allow for use of such software. (I will specify the restrictions when the assignments are given.)

Problems are not to be solved using ChatGBT or other AI because using these tools in such a manner doesn't foster the development of the math skills we are trying to learn in this class. Also, I encourage students to work together because I think working as a team fosters both learning and is conducive to problem solving. However, copying down other student's work is not permitted.

(There will also be nongraded homework assignments, which are designed to simply help you with the course and prepare you for the graded components. These problems will often be from the textbook.)

Outline of Material to Be Covered by Topics: The following list represents the minimum of what will be covered. Additional topics may be added if the need arises.

1. **Probability** (McQuarrie: Math Chapter J: pages 809-815; if you're unfamiliar or rusty with basic statistics, review McQuarrie Math Chapter B, pages 63-71)

- Types of Events (summary): This includes mutually exclusive events, complementary events, independent events and composite events
- Permutations and statistical weight, W
- Combinations and W
- Binomial Distribution and Coefficient
- Multinomial Distribution and Coefficient
- Macrostates and microstates

2. **Stirling approximation** (McQuarrie Math Chapter J: pages 811-813)

3. **Calculus of Multivariable Functions**

- Partial differentiation (McQuarrie: Math Chapter H, pages 683-691)
- Integration of multivariable functions (select examples from physical chemistry)
- Gaussian integrals
- Select operations and identities need for thermodynamics: Cyclic rule, reciprocal rule and other topics

4. **Optimization**

- Optimizing single-variable functions
- Optimizing multivariable functions
- Optimizing with constraints
- Solving a particle-in-a-box model as a homogeneous 2nd order ordinary differential equation with constant coefficients

5. **Math Overview of the First Law Thermodynamics**

- Exact differentials (McQuarrie Page 688-689)
- Inexact differentials (McQuarrie Page 688-689)
- Integrating factors (McQuarrie page 820, discussed briefly there)

Attendance Policy and Classroom Environment Expectations

General Attendance, Participation Policies, and Expectations

Attendance and participation in this course are expected and necessary for developing a good understanding of the material. In this class, we will work together to develop a learning community that is inclusive and respectful. As a learning community we will seek to encourage and appreciate expressions of different ideas, opinions, and beliefs in the spirit of Our Common Ground. Meaningful and constructive dialogue is encouraged in this class. This requires mutual respect, willingness to listen, and open-mindedness to opposing points of view. Respect for individual differences and alternative viewpoints will be maintained at all times in this class. Conduct that substantially or repeatedly disrupts the ability of faculty and instructors to teach and the ability of students to engage may result in my asking a student to temporarily leave the classroom. See Undergraduate Catalogue - Classroom Code of Conduct (p. 443-444).

Excused Absence Policies

If you intend on missing class to observe a religious holiday or to participate in inter-collegiate athletics, please submit the dates of your absence to me in writing by the end of the second week of classes. If you miss due to medical reason or because of an emergency, please inform me as soon as possible. In all the above cases, we will work together to develop a plan to make up work that you missed.

Course Evaluation

There will be an evaluation of the course at the end of the semester, which is anonymous and confidential. I appreciate all feedback and will use it to improve the course.

Intellectual Property Statement

Students are prohibited from publicly sharing or selling academic materials that they did not author. Violations will be handled under UVM's Intellectual Property policy and Code of Academic Integrity.

Other Resources

Diversity, Equity, and Inclusion Resources

The Division of Diversity, Equity, and Inclusion believes excellence should be inclusive of the entire University of Vermont (UVM) community and is steadfastly committed to this belief. Every day, our Division strives to make our work accessible, affirming, and action-oriented to help ensure excellence is inclusive of everyone.

<https://www.uvm.edu/diversity>

UVM Prism Center

The Prism Center serves the diverse queer and trans communities at the University of Vermont. We support and empower lesbian, gay, bisexual, transgender and queer students, as well as students whose identities fall in between or expand beyond those categories, and work to create a campus community where people of all sexual and gender identities can thrive.

<https://www.uvm.edu/prism>

Mosaic Center for Students of Color

The Mosaic Center for Students of Color (MCSC) Vision is to create a diverse and rich community of empowered, engaged, and enthusiastic students of color at UVM.

<https://www.uvm.edu/mcsc>

Interfaith Center

No matter how you make meaning of your life, you are welcome at the Interfaith Center for reflection, spiritual practice, education, and community building.

<https://www.uvm.edu/interfaithcenter>

Women & Gender Equity Center

The UVM Women & Gender Equity Center cultivates joyful community while advancing gender equity across identities. We envision a brave, diverse, and equitable learning environment for all members of the UVM community. We strive to provide programming and events that connect our community through the exploration of the intersections of their gender and other identities.

<https://www.uvm.edu/wagecenter>

Important University Policies

Academic Integrity

Offenses against the Code of Academic Integrity are deemed serious and insult the integrity of the entire academic community. Any suspected violations of the code are taken very seriously and will be forwarded to the Center for Student Ethics and Standards for further investigation. Violations of the Code of Academic Integrity—including any inappropriate collaboration, collusion, cheating, corroboration, plagiarism, or any other related offense—will be fully investigated according to the rules set by the UVM Academic Integrity Office and may be punishable with a score of zero for the assignment in question. Details can be found at <http://www.uvm.edu/policies/student/acadintegrity.pdf>.

Grade Appeals

If you would like to contest a grade, please follow the procedures outlined in this policy: <https://www.uvm.edu/policies/student/gradeappeals.pdf>

Code of Student Conduct

<http://www.uvm.edu/policies/student/studentcode.pdf>

FERPA Rights Disclosure

The purpose of this policy is to communicate the rights of students regarding access to, and privacy of their student educational records as provided for in the Family Educational Rights and Privacy Act (FERPA) of 1974.

<http://catalogue.uvm.edu/undergraduate/academicinfo/ferparightsdisclosure/>

Promoting Health and Safety

The University of Vermont's number one priority is to support a healthy and safe community:

Center for Health and Wellbeing: <https://www.uvm.edu/health>

Counseling & Psychiatry Services (CAPS): Please call 802-656-3340 for assistance.

C.A.R.E. If you are concerned about a UVM community member or are concerned about a specific event, we encourage you to contact the Dean of Students Office (802-656-3380). If you would like to remain anonymous, you can report your concerns online by visiting the Dean of Students website at <https://www.uvm.edu/studentaffairs>

General statement regarding potential changes during the semester:

<http://catalogue.uvm.edu/>

The University of Vermont reserves the right to make changes in the course offerings, mode of delivery, degree requirements, charges, regulations, and procedures contained herein as educational, financial, and health, safety, and welfare considerations require, or as necessary to be compliant with governmental, accreditation, or public health directives.

Intellectual Property Statement/Prohibition on Sharing Academic Materials

Students are prohibited from publicly sharing or selling academic materials that they did not author (for example: class syllabus, outlines or class presentations authored by the professor, practice questions, text from the textbook or other copyrighted class materials, etc.); and students are prohibited from sharing assessments (for example homework or a take-home examination). Violations will be handled under UVM's Intellectual Property policy and Code of Academic Integrity.

Student Learning Accommodations

In keeping with University policy, any student with a documented disability interested in utilizing ADA accommodations should contact Student Accessibility Services (SAS), the office of Disability Services on campus for students. SAS works with students and faculty in an interactive process to explore reasonable and appropriate accommodations, which are communicated to faculty in an accommodation letter. All students are strongly recommended to discuss with their faculty the accommodations they plan to use in each course. Faculty who receives Letters of Accommodation with Disability Related Flexible accommodations will need to fill out the Disability Related Flexibility Agreement. Any questions from faculty or students on the agreement should be directed to the SAS specialist who is indicated on the letter.

Contact SAS:

A170 Living/Learning Center;

802-656-7753

access@uvm.edu

www.uvm.edu/access

Important UVM Policies

Academic Integrity:

The Academic Integrity policy addresses plagiarism, fabrication, collusion, and cheating.

Code of Student Conduct

UVM's Code of Student Conduct outlines conduct expectations as well as students' rights and responsibilities.

Final Exam Policy

The University final exam policy outlines expectations during final exams and explains timing and process of examination period.

Grade Appeals

If you would like to contest a grade, please follow the procedures outlined in this policy.

Grading

This link offers information on grading and GPA calculation.

Religious Holidays

Students have the right to practice the religion of their choice. If you need to miss class to observe a religious holiday, please submit the dates of your absence to me in writing by the end of the second full week of classes. You will be permitted to make up work within a mutually agreed-upon time. The complete policy is here.