

**Chemistry 6520**  
**Thermodynamics**  
Fall Semester, Second Session 2022  
MWF 11:30 AM -12:25 PM

**Instructor:** Philip Grandinetti  
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**Objectives:** Introduction to thermodynamics; with an emphasis on chemistry.

**Recommended Texts:**

- *Atkins' Physical Chemistry 11e: Volume 1: Thermodynamics and Kinetics 11th Edition*, Atkins, de Paula, Keeler
- *Thermodynamics, Statistical Thermodynamics and Kinetics, 4th Edition*, Engel and Reid

**Math Prerequisite:** Multivariable calculus

**Syllabus:** 20 lectures covering the topics below

Topic
Forces and Work in Classical Physics
Stress, Strain, and Elasticity
Thermodynamic Definitions
Thermodynamics Equilibrium and Equations of State
Gas Equations of State
Kinetic Theory of Gases
Equipartition of Energy and Heat Capacity
The First Law
Thermodynamic Processes and State Functions
Thermodynamic Work
Heat
Thermochemistry
Gas Expansion
Carnot Engines
Entropy and the Second Law
Statistical Interpretation of Entropy
The Third Law
Processes
Thermodynamic Relationships
Phase Transitions and Equilibria of Pure Substances
Simple Mixtures
Chemical Equilibrium

No lectures on November 14th and 16th, and on December 7th.

Makeup lectures on Thursday, November 17th and Thursday, December 1st. Time: 5-6:30 pm (1.5 h/lecture)

**Grading:**

Homework	30%	Will be assigned during lecture
Midterm Exam	30%	Date: November 10, 5:30 PM - 7:30 PM, TBA
Final Exam	40%	Date: December 15, 10:00 AM - 11:45 PM

Make-up exams will be given only for documented medical reasons, or pre-approved university conflicts. Students with University conflicts should provide the lecturer with their complete course schedule, including the conflict, at least two weeks before the exam so an alternate exam can be scheduled.

## Grading Scheme:

Grade	Range		
A	100%	to	85%
A-	< 85%	to	75%
B+	< 75%	to	65%
B	< 65%	to	50%
B-	< 50%	to	40%
C	< 40%	to	30%

## Homework Assignments:

All completed homework assignments will be submitted as electronic pdf files. Please follow the following guidelines when preparing your answers for grading.

1. Write legibly.
2. First write down the mathematical equation with symbols and leave the numerical substitution at the end. No credit will be given for solutions that do not have symbolic equations.
3. Whenever the assignment asks you to prove an equation, use logical reasoning to derive it. No credit will be given if the answer is right but the intermediate steps have serious mathematical or physical mistakes.
4. Every physical quantity should include the appropriate S.I. unit.

## Policies

- Audio or video recording of class is not allowed without permission.
- Posting any course materials online is not permitted.
- All cell phones must be silenced during class. Students should refrain from texting, listening to headphones, e-mailing during class unless it is part of the lecture.

## Advice for doing well in this class

The best piece of advice is work (correctly) through every single homework problem, and understand deeply why you got the correct answer. Of course, that's easier said than done, so here are a few other tips to help you succeed:

1. Read the notes and text before each lecture. Even better if you can read ahead a few lectures. Note down the things you don't understand and be prepared to ask about them in class.
2. Attend lecture! Statistics show that students who skip lecture do the worst.
3. Ask questions in lecture when you don't understand. Don't be embarrassed, chances are quite high that others in the class have the same question in their heads.
4. Don't waste a lot of time working on questions when you can't get the right answer. If you're still stuck, talk to your TA or me.
5. Start early, and don't fall behind. Students who do well in this course often spend about **10 hours each week** (outside of lecture) reading and re-reading through the notes and text, and asking questions, while they work on the homework assignments.

## Requirements Fulfilled

Chemistry 6520 is a Physical Science course in the Natural Science category of the GE, which has these goals and objectives:

**Goals:** Students understand the principles, theories, and methods of modern science, the relationship between science and technology, the implications of scientific discoveries and the potential of science and technology to address problems of the contemporary world.

### Learning Objectives:

1. Students understand the basic facts, principles, theories and methods of modern science.
2. Students understand key events in the development of science and recognize that science is an evolving body of knowledge.
3. Students describe the inter-dependence of scientific and technological developments.
4. Students recognize social and philosophical implications of scientific discoveries and understand the potential of science and technology to address problems of the contemporary world.

## Health and safety requirements:

All students, faculty and staff are required to comply with and stay up to date on all university safety and health guidance (<https://safeandhealthy.osu.edu>), which includes wearing a face mask in any indoor space and maintaining a safe physical distance at all times. Non-compliance will be warned first and disciplinary actions will be taken for repeated offenses.

## Standards Of Academic Conduct

**Any material submitted must represent your own work. Violations of this standard will be referred to the University Committee of Academic Misconduct (COAM) as required by Faculty Rules.**

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term “academic misconduct” includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee (Faculty Rule 3335-5-487). For additional information, see the Code of Student Conduct <http://studentlife.osu.edu/csc>

Copying, use of “crib” material, or use of stored constants and formulas in calculators on quizzes, examinations or the final exam is regarded as a severe violation of academic standards no matter how small the action. The Department of Chemistry will recommend as the **minimum penalty a grade of E for the course for any such violations.**

## Statement on Diversity and Title IX

The Ohio State University affirms the importance and value of diversity in the student body. Our programs and curricula reflect our multicultural society and global economy and seek to provide opportunities for students to learn more about persons who are different from them. We are committed to maintaining a community that recognizes and values the inherent worth and dignity of every person; fosters sensitivity, understanding, and mutual respect among each member of our community; and encourages each individual to strive to reach his or her own potential. Discrimination against any individual based upon protected status, which is defined as age, color, disability, gender identity or expression, national origin, race, religion, sex, sexual orientation, or veteran status, is prohibited.

Title IX makes it clear that violence and harassment based on sex and gender are Civil Rights offenses subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories (e.g., race). If you or someone you know has been sexually harassed or assaulted, you may find the appropriate resources at <http://titleix.osu.edu> or by contacting the Ohio State Title IX Coordinator at [titleix@osu.edu](mailto:titleix@osu.edu)

## Your mental health

As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student’s ability to participate in daily activities. The Ohio State University offers services to assist you with addressing these and other concerns you may be experiencing. If you or someone you know are suffering from any of the aforementioned conditions, you can learn more about the broad range of confidential mental health services available on campus via the Office of Student Life’s Counseling and

Consultation Service (CCS) by visiting [ccs.osu.edu](http://ccs.osu.edu) or calling 614-292-5766. CCS is located on the 4th Floor of the Younkin Success Center and 10th Floor of Lincoln Tower. You can reach an on call counselor when CCS is closed at 614-292-5766 and 24 hour emergency help is also available through the 24/7 National Suicide Prevention Hotline at 1-800-273-TALK or at [suicidepreventionlifeline.org](http://suicidepreventionlifeline.org).

## **Disability Services (ODS)**

The University strives to make all learning experiences as accessible as possible. If you anticipate or experience academic barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can privately discuss options. To establish reasonable accommodations, I may request that you register with Student Life Disability Services. After registration, make arrangements with me as soon as possible to discuss your accommodations so that they may be implemented in a timely fashion. SLDS contact information: [slds@osu.edu](mailto:slds@osu.edu); 614-292-3307; [slds.osu.edu](http://slds.osu.edu); 098 Baker Hall, 113 W. 12th Avenue.