Physics and Engineering
School of STEM

PHY/EGR 4013 Thermodynamics

3 Units

Fall 2025

Meeting days/times (MWF 1:30 pm – 2:25 pm)

Meeting location (Rohr Science (RS) 265)

Final Exam: (Friday, 12/19, 1:30 – 4:00 pm)

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Office Location and Office Hours: RS 282 by Appointment

PLNU Mission

To Teach ~ To Shape ~ To Send

Point Loma Nazarene University exists to provide higher education in a vital Christian community where minds are engaged and challenged, character is modeled and formed, and service is an expression of faith. Being of Wesleyan heritage, we strive to be a learning community where grace is foundational, truth is pursued, and holiness is a way of life.

Department Mission

PHE: The Department of Physics & Engineering provides strong programs of study that aid in ensuring our students are well prepared for both graduate studies and careers in a variety of scientific and engineering fields. We emphasize a collaborative learning environment that allows students to thrive academically, build personal confidence, and develop interpersonal skills, while providing a Christian setting for students to learn values and judgment and pursue integration of modern scientific knowledge and Christian faith.

Course Description

Fundamental concepts of thermodynamics and statistical mechanics; applications to both classical and quantum systems.

Program and Course Learning Outcomes

Through this course students develop skills so they will be able to:

1. Distinguish between conduction, convection, and radiation, and apply appropriate models to analyze thermal systems.
2. Interpret thermodynamic phenomena from both macroscopic and microscopic viewpoints.
3. Express physical principles in mathematical form, select appropriate governing equations, and solve for relevant thermodynamic properties.
4. Calculate entropy changes in physical processes and explain the implications of the Second Law of Thermodynamics for natural and engineered systems.
5. Use concepts such as microstates, partition functions, and distribution functions to connect microscopic models with macroscopic observables.

STUDENT OUTCOMES ADDRESSED

Students will have:

1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics (LO1).

Required Texts and Recommended Study Resources

An Introduction to Thermal Physics by Daniel V. Schroeder (2000).

Students are responsible for having the required course textbooks prior to the first day of class.

All supplemental materials posted on this course site (including articles, book excerpts, or other documents) are provided for your personal academic use. These materials may be protected by copyright law and should not be duplicated or distributed without permission of the copyright owner.

Assessment and Grading

Grades will be based on the following:

- **Homework:** Homework will be assigned weekly, and a physical copy is due at the start of class the following week.
- **Examinations and the Final Examination**. Examinations and the Final Examination will include problems and questions over material assigned in the text, readings, and handouts, as well as material presented in class. No examination shall be missed without prior consent or a well-documented emergency beyond your control. A score of zero will be assigned for an examination that is missed without prior consent or a well-documented emergency beyond your control. The final exam date and time is set by the university at the beginning of the semester and may not be changed by the instructor. This schedule can be found on the university website and in the course calendar. No requests for early examinations will be approved. Only in the

case that a student is required to take three exams during the same day of finals week, is an instructor authorized to consider changing the exam date and time for that particular student.

Sample Standard Grade Scale Based on Percentages

Standard Grade Scale Based on Percentages					
	A	B	C	D	F
+		87.5- 89.5	77.5-79.5	67.5-69.5	
	91 -100	81-87.5	71-77.5	61 -67.5	0-57
_	89.5-91	79.5-81	69.5-71	57-61	

Grading Distribution	Percent
Homework	25
Exams	35
Final Exam	40
Total	100

Final Examination Policy

Successful completion of this class requires taking the final examination on its scheduled day. The final examination schedule is posted on the Traditional Undergraduate Records: Final Exam Schedules site. If you find yourself scheduled for three (3) or more final examinations on the same day, you are authorized to contact each professor to arrange a different time for one of those exams. However, unless you have three (3) or more exams on the same day, no requests for alternative final examinations will be granted.

Incompletes and Late Assignments

All assignments are to be submitted/turned in by the beginning of the class session when they are due—including assignments posted in Canvas. Late assignments will receive a score of zero.

Artificial Intelligence (AI) Policy

You are allowed to use Artificial Intelligence (AI) tools (e.g., ChatGPT, Gemini Pro 1.5, GrammarlyGo, Perplexity, etc) to generate ideas, but you are not allowed to use AI tools to generate content (text, video, audio, images) that will end up in any work submitted to be graded for this course. If you have any doubts about using AI, please gain permission from the instructor.

PLNU Academic Accommodations Policy

PLNU is committed to providing equal opportunity for participation in all its programs, services, and activities in accordance with the Americans with Disabilities Act (ADA). Students with disabilities may request course-related accommodations by contacting the Educational Access Center (EAC), located in the Bond Academic Center (EAC@pointloma.edu or 619-849-2533). Once a student's eligibility for an accommodation has been determined, the EAC will work with the student to create an Accommodation Plan (AP) that outlines allowed accommodations. Professors are able to view a student's approved accommodations through Accommodate.

PLNU highly recommends that students speak with their professors during the first two weeks of each semester/term about the implementation of their AP in that particular course. Accommodations are not retroactive so clarifying with the professor at the outset is one of the best ways to promote positive academic outcomes.

Students who need accommodations for a disability should contact the EAC as early as possible (i.e., ideally before the beginning of the semester) to assure appropriate accommodations can be provided. It is the student's responsibility to make the first contact with the EAC. Students cannot assume that because they had accommodations in the past, their eligibility at PLNU is automatic. All determinations at PLNU must go through the EAC process. This is to protect the privacy of students with disabilities who may not want to disclose this information and are not asking for any accommodations.

LomaBooks Instructions for Students

This course is part of our course material delivery program, **LomaBooks**. The bookstore will provide each student with a convenient package containing all required physical materials; all digitally delivered materials will be integrated into Canvas.

You should have received an email from the bookstore confirming the list of materials that will be provided for each of your courses and asking you to select how you would like to receive any printed components (in-store pick up or home delivery). If you have not done so already, please confirm your fulfillment preference so the bookstore can prepare your materials.

For more information about **LomaBooks,** please go: HERE

Additional Course Information

Additional PLNU policies and practices that apply to this course can be found at the following link:
https://docs.google.com/document/d/11BgAANLOJ9tjt837d24EZ181ukM2qzHF/edit

Tentative Schedule (Subject to Updates)

Date	Topics	Reading	Homework
3-Sep	Introductions and Temperature	1.1	
5-Sep	Ideal Gas, Equipartition Theorem	1.2-1.3	
8-Sep	Heat and Work	1.4-1.5	
10-Sep	Heat and Work cont.	1.4-1.5	
12-Sep	Heat Capacity	1.6	HW1
15-Sep	Latent Heat, Enthalpy	1.6	
17-Sep	Microstates and Multiplicities	2.1-2.2	
19-Sep	The Second Law	2.3	HW2
22-Sep	Large Systems	2.4	
24-Sep	Ideal Gas	2.5	
26-Sep	Entropy	2.6	HW3
29-Sep	Review		
1-Oct	**Exam 1**		
3-Oct	Temperature	3.1	HW4
6-Oct	Temperature cont.	3.1	
8-Oct	Entropy and Heat	3.2	
10-Oct	Entropy and Heat cont	3.2	HW5
13-Oct	Paramagnetism	3.3	
15-Oct	Pressure	3.4	
17-Oct	Chemical Potential	3.5-3.6	HW6
20-Oct	Chemical Potential cont.		
22-Oct	Free Energy	5.1	
24-Oct	Fall Break		
27-Oct	Phase Transformation	5.3	
29-Oct	Clausius-Clapeyron Relation	5.3	HW7
31-Oct	**Exam 2**		
3-Nov	Heat Engines	4.1	
5-Nov	Refrigerators	4.2 (4.3-4.4)	
7-Nov	Boltzmann Factor	6.1	HW8
10-Nov	The Partition Function	6.1	
12-Nov	Equipartition Theorem	6.3	
14-Nov	Maxwell Speed Distribution	6.4	HW9
17-Nov	Partition Functions and Free Energy	6.5	
19-Nov	Ideal Gas	6.7	
21-Nov	Gibbs Factor	7.1	HW10

24-Nov	**Exam 3**		
26-Nov	Thanksgiving Break		
28-Nov	Thanksgiving Break		
1-Dec	Bosons and Fermions	7.2	
3-Dec	Bosons and Fermions cont	7.2	
5-Dec	Degenerate Fermi Gas	7.3	HW11
8-Dec	Blackbody Radiation	7.4	
10-Dec	CMB and Photon Escaping	7.4	
12-Dec	Radiation from Objects	7.4	HW12
19-Dec	Final Exam @ 1:30pm		