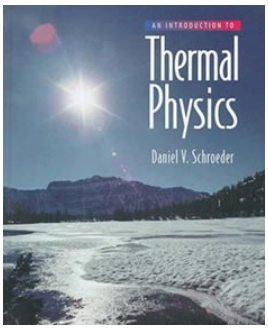

PHYS 330: Thermodynamics

2024 Spring Semester
Lecture: MWF 11:30-12:25, KTH 2039
Instructor: Dr. Steven Gibson
Office: KTH 2011, **Hours:** By appointment
Phone: 270-745-3019, **Email:** (first).(last) (at) wku.edu
Text: *An Introduction to Thermal Physics*, by Daniel V. Schroeder (2000, Addison-Wesley, ISBN 978-0-201-38027-9; reprinted 2021, Cambridge U. Press, ISBN 978-0-19-289554-7, 978-0-19-289555-4)

Pre-requisites: PHYS 321 (Modern II), MATH 237 (Multivar.), and MATH 331 (Diff.Eq.)

Catalog Description: 3 Credit Hours. A study of thermodynamic systems, equations of state, entropy, Maxwell-Bolzmann and quantum statistics.

Course Learning Outcomes:
As a result of working through this course, you will be able to:

- ◇ Understand the physical meaning of entropy and its relation to macroscopic phenomena like temperature, pressure, chemical potential, or free energy.
- ◇ Explain how the number of degrees of freedom affects internal energy and heat capacity of physical systems.
- ◇ Quantitatively describe the behavior of an ideal gas during a thermodynamic processes, such as expansion or heating.
- ◇ Describe the functioning of a heat engine, and explain why its energy efficiency is limited.
- ◇ Compare and contrast Fermi-Dirac and Bose-Einstein quantum statistics, and give examples of the application of each.

Course Philosophy: This is an upper-level course requiring significant focus and maturity for successful students. Lectures will focus only on the most critical and challenging material. *You are expected to read all assigned text on your own, including topics not discussed in class!* You are also expected to be familiar with recommended homework problems, *even though these will not be graded*. Instead, most of your course grade will be based upon frequent exams that will test your knowledge of the material, including your ability to solve problems.

Course Website: All announcements, including assigned reading, laboratories, and exam dates, will be posted on Blackboard along with other potentially useful materials.

Grading Method: Letter grades for the course will be assigned using the scheme shown at left below. Grade threshholds may be lowered but will not be raised. The relative weights of the course components contributing to the final course score are listed at right below.

% Avg Score	Grade
90 - 100	A
80 - 89	B
70 - 79	C
60 - 69	D
0 - 59	F

Course Component	Grade Fraction
in-class exercises, quizzes	10%
block exams ($[6-1] \times 13\%$)	65%
final exam	25%

Course Components

- **Reading Quizzes:** You are responsible for reading assignments I will give in class. These are intended to familiarize you with material before it is covered in lecture or class discussions, so that you can grasp important points as they arise rather than frantically trying to note down everything that is said. I will give reading quizzes worth a small fraction of your total grade to encourage you in this regard.

- **In-Class Activities:** There will also be in-class activities for credit. Most of these will be group conceptual or problem-solving exercises for "participation points" rather than a grade. Others may be graded, e.g., a quiz or short presentation.

- **Homework:** *There is no formal homework in this class, and no part of your course grade will depend DIRECTLY on homework.* However, you are strongly encouraged to work "suggested" problems that will be announced for each chapter in the text as an aid to learning the material. Suggested problems are fair game for exams! Discussion of problems with other students is encouraged as a constructive learning activity. But take care to ensure that you can solve the problems by yourself in case they appear on an exam.

- **Block Examinations** will be given during the semester on successive "blocks" of material. Each is worth 13% of your course grade. *The lowest block exam score will be dropped.* The exact topics for each exam are subject to change, but may resemble the following:

Block	Sections	Sample Topics (not complete list!)
1	1.1 - 1.6	Energy: Ideal Gas, Equipartition, Work, Heat Capacity
2	2.1 - 2.6	2nd Law: 2-State Systems, Einstein Solid, Large Systems
3	3.1 - 3.6	Interactions: Temperature, Entropy, Heat, Paramag., Equilibria
4	4.1-4, 5.1-3	Heat Engines, Refrigerators, Free Energy, Phase Transitions
5	6.1 - 6.7	Boltzmann Factor, Maxwell Distribution, Partition Functions
6	7.1 - 7.6	Gibbs Factor, Fermi-Dirac, Bose-Einstein, Debye Solids

- **Final Examination:** The final exam for the course will be comprehensive, covering material from the entire semester of the course. As of this writing, the University-mandated final exam date and time for this course are **Wednesday, May 1, 10:30am - 12:30pm** .

Problem Credit: On exams, you need to do more than just write down the answer to a problem to receive full credit. I want to be able to follow your reasoning so I can see how you got what you got. In this way I can also give partial credit for wrong or incomplete answers if I can tell you were on the right track. All numerical problem solutions should include the following elements:

1. A sketch or graph of the situation with suitable labels
2. Appropriate *algebraic* equations (no numbers!) relating known & unknown quantities
3. Solved quations with proper numerical values & units for known quantities
4. Numerical answer for the "unknown" you were trying to find, including proper units
5. Neatness counts! I can't give credit for anything I can't follow.

Lecture Attendance: Regular and punctual attendance is expected of everyone during every class meeting. You will be responsible for material missed in your absence. Lecture notes must be obtained from a classmate.

Exam Attendance: Make-up exams will only given in very unusual circumstances. If you are unable to take an exam, request to schedule a make-up exam by asking permission from the instructor *before* the regularly-scheduled exam period (except in the case of unforeseen circumstances). A serious reason is required to warrant the scheduling of a make-up exam.

University Policies: Information on a range of important topics, including ADA Accommodations, Student Code of Conduct, Title IX Misconduct/Assault, Emergency Preparedness, etc., is available at www.wku.edu/syllabusinfo.

Academic Dishonesty (including plagiarism, test-sharing, etc.) will not be tolerated. According to the WKU Student Handbook: *"Students who commit any act of academic dishonesty may receive from the instructor a failing grade in that portion of the course work in which the act is detected, or a failing grade in a course without possibility of withdrawal. The faculty member may also present the case to the Office of Student Conduct for disciplinary action."* **Please be aware that cheating includes seeking help from online sources, or giving or receiving aid on work that must be submitted as your own. DO NOT TAKE THIS RISK!**

Artificial intelligence (AI) tools are not permitted for any type of work in this class. If you choose to use these tools, your actions will be considered academically dishonest and a violation of the WKU Student Code of Conduct.

ADA Accommodation: In compliance with University policy, tudents with disabilities who require academic and/or auxiliary accommodations for this course must contact the Student Accessibility Resource Center located in Downing Student Union, 1074. SARC can be reached by phone at 270-745-5004 [270-745-3030 TTY] or via email at sarc.connect@wku.edu. Please do not request accommodations directly from the instructor without a faculty notification letter from the SARC.

Title IX Misconduct/Assault: Western Kentucky University (WKU) is committed to supporting faculty, staff and students by upholding WKU's Sex and Gender-Based Discrimination, Harassment, and Retaliation (#0.2070) and Discrimination and Harassment Policy (#0.2040). Under these policies, discrimination, harassment and/or sexual misconduct based on sex/gender are prohibited. If you experience an incident of sex/gender-based discrimination, harassment and/or sexual misconduct, you are encouraged to report it to the Title IX Coordinator, Andrea Anderson, 270-745-5398 or Title IX Investigators Michael Crowe (270-745-5429) or Joshua Hayes (270-745-5121). Please note that while you may report an incident of sex/gender based discrimination, harassment and/or sexual misconduct to a faculty member, WKU faculty are Responsible Employees of the University and MUST report what you share to WKU's Title IX Coordinator or Title IX Investigator. If you would like to speak with someone who may be able to afford you confidentiality, you may contact the WKU Counseling and Testing Center at 270-745-3159.