

Thermodynamics (PHY 304)

Spring 2018

Scott N. Walck

Contact Information

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Course Description

A study of the physics of temperature and heat, with emphasis on the first, second, and third laws of thermodynamics. 3 credits.

Learning Objectives

It is expected that students will

1. describe thermodynamic quantities using the mathematical language of partial derivatives
2. interpret the relationship between temperature and energy
3. apply the First Law of Thermodynamics to specific physical situations
4. calculate energies and entropies in specific physical situations
5. explain the role of entropy in thermodynamics

Textbook

The textbook for the course is *Thermodynamics and Statistical Mechanics*, by Robert J. Hardy and Christian Binek, Wiley (2014), ISBN 978-1-118-50101-6.

Exams

There will be three 80-minute exams during the normal class time. There will also be a comprehensive final exam. No computers, cell phones, or any electronic devices with wireless or network capability are allowed during exams. You will be allowed to use a calculator during exams.

Homework

The homework is the centerpiece of this course. It is in doing the homework problems that you will begin to understand thermodynamics. You cannot succeed with this subject if you wait until the day before the homework is due to start. Start the homework a week before the due date by reading the problems and seeing if you can do any of them. Come to me with questions, or if you get stuck.

You may work together on the homework, talking about how to solve the problems, but you must write your homework solutions independently. Do not copy homework solutions from the web or from your classmates. Copying another person's homework solutions is an act of cheating and plagiarism. Everything that you write in your homework solutions you should be able to explain to me if I were to ask. This does not mean that your homework needs to be perfect, only that it must have come from your mind.

If you can't finish some of the problems before the due date, turn in what you have done. If you know in advance that you will have trouble finishing the homework by the deadline, come and talk to me.

Class Participation

A portion of your grade is determined by class participation. Obviously, attendance is a prerequisite for participation in class.

On some days, you are responsible for giving the class an oral summary of the section. We will flip a coin to see which of the two people assigned to prepare a summary will give the summary. The winner of the coin flip gets to give the summary; the other person gets to make any additional remarks they wish afterward. Aim for a 3-minute summary. Some sections will need more time; some will need less. Try to identify the 3 most important ideas in the section. If you need a number other than 3, that's fine.

On some days, you are responsible for preparing a question about the material in the section. The question should probe the edges of your understanding of the material. You may write a question about something the author wrote that you don't understand. You may write a question about how or whether the author's ideas apply in some situation. You may write a question about how an idea presented in the current section is related to something you've learning previously, or something the author wrote in an earlier section. These questions are not intended to be exam-like questions or problems that might appear on a test. Rather, they are intended to be honest questions driven by confusion or curiosity.

A number of people are asked to write a question for each section. These questions should be rather different from each other. I don't want to get the same question from multiple people. Please give me these questions at the very beginning of class, and I will insert them into the conversation as I can. I will keep your questions, so please make a copy in advance so that you also have a copy of the question.

If you attend every class, and participate by preparing summaries, asking questions, answering questions, and taking your turn in doing problems at the board, you will have a perfect score for this area. If you need to miss a class, see me in advance and I'll give you an alternative assignment.

Grading

Your grade will be determined by a weighted average as indicated in the table below.

Exams	45%
Homework	30%
Class Participation	10%
Final Exam (comprehensive)	15%

Your letter grade for the course is determined by the weighted average. The minimum weighted average (out of 100) required for each letter grade is indicated below.

A	93
A-	90
B+	87
B	83
B-	80
C+	77
C	73
C-	70
D+	67
D	63
D-	60
F	0

Office Hours

Please feel free to stop by my office any time to chat. I will make a special effort to be in my office during the office hours posted on my door (also listed on my web page). We can also make an appointment to get together if that is convenient for you.

Academic Honesty

Any student who submits plagiarized work will be subject to the penalties described in the Student Handbook and outlined in LVC's "Academic Honesty Policy" (<http://www.lvc.edu/catalog/acad-reg-procedures.aspx>). *This code asks each student to do his/her own work in his/her own words.*

A student shall neither hinder nor unfairly assist the efforts of other students to complete their work. All individual work that a student produces and submits as a course assignment must be the student's own. Cheating and plagiarism are acts of academic dishonesty.

Cheating is an act that deceives or defrauds. It includes, but is not limited to, looking at another's exam or quiz, using unauthorized materials during an exam or quiz, colluding on assignments without the permission or knowledge of the instructor, and furnishing false information for the purpose of receiving special consideration, such as postponement of an exam, essay, quiz or deadline of an oral presentation.

Plagiarism is the act of submitting as one's own the work (the words, ideas, images, or compositions) of another person or persons without accurate attribution. Plagiarism

can manifest itself in various ways: it can arise from sloppy note-taking; it can emerge as the incomplete or incompetent citation of resources; it can take the form of the wholesale submission of other people's work as one's own, whether from an online, oral or printed source.

Students who take part in violations such as cheating or plagiarism are subject to a meeting with the Associate Dean of Academic Affairs, who has the authority to take further action, up to and including expulsion from the College.

Disabilities Services Syllabus Statement

Individuals with disabilities are guaranteed certain protections and rights of equal access to programs and activities under Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act Amendments Act (ADAAA) of 2008. Therefore, Lebanon Valley College recognizes the responsibility of the college community to provide equal educational access for otherwise qualified students with disabilities.

Any student who needs classroom or testing accommodations is invited to present letters from the Center for Disability Resources and discuss accommodations with me after class or during office hours. The Center for Disability Resources is located in the Lebegern Learning Commons—Mund Suite 002. Students may schedule an appointment by calling 717-867-6028.

If a student believes that appropriate accommodations are being denied, the student may file a grievance. Procedures for filing grievances may be found at <http://www.lvc.edu/disability-resources/students-rights-responsibilities.aspx>.

Inclusive Excellence

LVC is a community of inclusive excellence. We affirm the rights of all persons to a superior educational experience that is characterized by respect for others. As such, this class and all classes at LVC, are places where our core values of inclusiveness, civility and appreciation of difference are affirmed.

Title IX

Lebanon Valley College prohibits discrimination on the basis of race, color, national origin, ancestry, religion/creed, sex, pregnancy, sexual orientation, gender identity or expression, age, disability, genetic information, marital/familial status, or veteran status in all programs and activities, as required by Title IX of the Educational Amendments of 1972, the Americans with Disabilities Act of 1990, Section 504 of the Rehabilitation Act of 1973, Title VII of the Civil Rights Act of 1964, and other applicable statutes and/or College policies.

Title IX makes it clear that violence, harassment, and any type of sexual misconduct based on sex and gender are civil rights violations. If you or someone you know has experienced violence, discrimination, or harassment, support is available through Counseling Services, Health Service, the Chaplain's office, the Victim Advocacy Program, and Title IX deputies. Please refer to the Student Handbook for specific contact information.

Student Success Intervention Team

At Lebanon Valley College, we want you to succeed in and out of the classroom. Administrators and faculty work together to ensure not only academic success but a highly productive and positive four-year experience. Students who are not performing to their potential can be referred to the Student Success Intervention Team (Early Alert Committee), which is a group of individuals from Student Affairs, Academic Affairs, and Enrollment Management. This group will guide you through any difficult situation, whether academic or personal. You should, consider it your assignment to follow through and accept assistance from the appropriate source(s). Don't be afraid or hesitant to seek help from these individuals: supporting you is their job! Be proactive and take control of your success.

Class Schedule

Date	Topic	Read before class	Due
01/16	Welcome		
01/18	Fundamentals	1.1–1.6	
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01/23	No class		
01/25	First Law of Thermo	2.1–2.4	HW 1
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01/30	Properties	3.1–3.3	HW 2
02/01	Partial Derivatives	3.4–3.5	
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02/06	Ideal Gases	4.1–4.2	HW 3
02/08	Cyclic Processes	4.3–4.4	
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02/13	Phase Transitions	5.1–5.2	HW 4
02/15	Phase Transitions	5.3–5.4	
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02/20	Exam 1 (Ch 1–4)		
02/22	Reversibility	6.1–6.2	HW 5
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02/27	Conduction	6.3–6.4	
03/01	Second Law	7.1–7.3	HW 6
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03/06	No class		
03/08	No class		
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03/13	Carnot Cycle	7.4–7.6	
03/15	Absolute Zero	8.1–8.3	HW 7
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03/20	State Space	9.1–9.3	HW 8
03/22	Differentials	9.4–9.6	

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03/27	Exam 2 (Ch 5–8)		
03/29	Entropy	10.1–10.3	HW 9
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04/03	Entropy	10.4–10.5	
04/05	Third Law	10.6–10.7	
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04/10	Applications	11.1–11.3	HW 10
04/12	Applications	11.4–11.6	
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04/17	Potentials	12.1–12.3	HW 11
04/19	Potentials	12.4–12.5	
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04/24	Molecular Models	15.1–15.3	HW 12
04/26	Exam 3 (Ch 9–12)		
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05/01	Molecular Models	15.4–15.6	HW 13