Physics 317: THERMODYNAMICS

Spring 2024

The course meets:
Tuesdays, **Wednesdays**, and **Fridays** at **9:30 – 10:20 am** in **ECS 104**
(or, via Zoom at **https://uvic.zoom.us/j/3347938652** if ever required to be online).
Tutorial sessions: **Fridays at 1:30 – 2:20 pm** (with tutorial leader Afif Omar, **aafif@uvic.ca**)
in **David Strong Bldg. C108** (or, via Zoom at
https://uvic.zoom.us/j/6421365475?pwd=YzVETEszLythSWlkNE01eEZmQitYdz09 if ever required to be online).
Labs will be in Elliott 125 at your scheduled afternoon or evening times.

Fearless leader: Justin Albert
Office: Elliott 213
Office Phone: (250) 721-7742
Cell Phone: (250) 661-7066
E-mail: jalbert AT uvic DOT ca

Office hours: Come by anytime! Or, chat with me anytime via the above Zoom link, or via Skype, my Skype name is jalbertuvic ! I'll be sure to stay available for an hour after each class, but please send e-mail or call if you want to be absolutely sure I will be in my office/available at any given time. If I'm in my office but busy I'll let you know a time to come back. Feel free to always try my office though, or phone, or e-mail. Cell phone is (250) 661-7066, feel free to call! (I tend to prefer e-mail to text messaging – and e-mail actually tends to reliably get to me faster than texting.) My lab space is in Elliott 022, so you can often find me there too.

Course homepage: https://bright.uvic.ca/d2l/home/301783

Text (required): Ashley H. Carter, *Classical and Statistical Thermodynamics*, 4th edition (or you can also use basically any other edition, e.g. the international edition), Cambridge Univ. Press, 2000. Please read the textbook sections provided in Brightspace near the beginning of the week that they are covered!

Some other sources that I occasionally consult:
Turns + Pauley, *Thermodynamics*, Cambridge Univ. Press, 2nd Ed., 2020.
Kittel + Kroemer, *Thermal Physics*, Freeman, 2nd Ed., 1980.
Reif, *Statistical and Thermal Physics*, McGraw-Hill, 1965.

Prerequisites: Phys 110 or 120, and Math 200 (or 202, or 205)

Midterm Date: **Friday, Feb. 16** (during class time) -- we'll have a review session (optional but useful) on **TBD** in the usual classroom (ECS 104).
Final date: **TBD in TBD** — review session starting at **TBD** in the usual

classroom (ECS 104).

Grade will be based 30% on the weekly problem sets above, 15% on a 1-hour midterm exam, 20% on your laboratory work, and 35% on the final exam. Your lowest problem set score will be dropped.

Please note UVic's correspondence between percentage points and letter grades: A+: 90 or more; A: 85-89; A-: 80-84; B+: 77-79; B: 73-76; B-: 70-72; C+: 65-69; C: 60-64; D: 50-59; F: below 50.

Problem sets: Problem sets are due at the beginning of class on Tuesday (first one due on Tue., Jan. 24th). Answers will be posted the following Tuesday.

You are allowed *one* **late homework** without penalty, up to a week late (along with the one lowest problem set score that is dropped). **All** other late homeworks count 50% if completed before the answer key is handed out the following week. Afterwards, it counts 10% (there is still a little bit of value in copying over the answers to better understand them). No exceptions (other than death in the immediate family, signed doctor's note). Note that the lowest homework score is dropped, and another homework can be a week late, so that covers cold/flu issues.

*Collaboration on the homework is **at your discretion***. Each person is responsible for doing his/her share of the work, **writing up her/his own solutions and for listing his/her collaborators on each set**.

Exams are closed book, closed notebook. You will be allowed to bring an 8.5" x 11" formula sheet of your own making (double-sided) to each exam.

Calculator: The only acceptable calculator for student use on exams (as per the department policy) is the Sharp EL-510RB. It is available at the UVic Bookstore for approximately $8.95.

The midterm exam will be held in class. No makeups will be given (other than hospitalization, death in the immediate family, signed doctor's note).

Academic Integrity Policy

(If you have any questions on this, please just ask me.)

I take Academic Integrity in this course extremely seriously.
You can find UVic's Policy on Academic Integrity in the Calendar; here is a link.
In overview, your responsibilities are:

- **For the exams:** You must complete all work on your own without help from *another person or from **any** outside sources* (for outside sources, except in cases when expressly permitted).
- **For the labs:** You must submit your own original work. You may seek help or advice from me, your lab instructor, or from another student. You may not copy or paraphrase from another student. You may not permit your work to be copied or paraphrased by another student.
- **For the assignments:** You must undertake the work yourself. You may seek advice or help from me, other students, or other people, but you are responsible for undertaking and understanding the work you submitted.

Please let me know anytime if you have any questions!!!

Below is the outline of the topics that will be covered in the course. Note that sections marked with an * will likely be skipped (although you might find that those starred sections make for useful/interesting background material).

Chapter 1. Introductory Remarks

- 1.1 Introduction
- 1.2 Caloric, Calories, Heat and Energy
- 1.3 Extensive and Intensive Quantities
- 1.4 Mole
- 1.5 Prepositions
- 1.6 Applicability of Equations

Chapter 5. Thermodynamic Processes

Chapter 3. Temperature

- 3.1 Introduction
- 3.2 Zeroth Law of Thermodynamics
- 3.3 Temperature Scales (1)
- 3.4 Temperature Scales (2)
- 3.5 Exercises

*(The fact that I have Chapters 5 and 3 here is **not** a typo – I will cover Chapters 5 and 3 of the lecture notes **second**, between Chapters 1 and 2, just in order to be more consistent with the order that the topics are covered in the Carter textbook.)*

Chapter 2. Partial Derivatives

- 2.1 Introduction
- 2.2 Partial Derivatives
- 2.3 Implicit Differentiation
- 2.4 Product of Three Partial Derivatives
- 2.5 Second Derivatives and Exact Differentials
- 2.6 Euler's Theorem for Homogeneous Functions *
- 2.7 Undetermined Multipliers *
- 2.8 Dee and Delta *

Chapter 6. Properties of Gases

- 6.1 The Ideal Gas Equation
- 6.2 Real Gases
- 6.3 Van der Waals and Other Gases
- 6.4 Gas, Vapour, Liquid and Solid

Chapter 7. The First and Second Laws of Thermodynamics

- 7.1 The First Law of Thermodynamics, and Internal Energy
- 7.2 Work

Chapter 4. Thermal Conduction

- 4.1 Introduction
- 4.2 Thermal Conductivity
- 4.3 The Heat Conduction Equation
- 4.0 The Error Function

*(The fact that I have Chapter 4 here [after sections 6.4, 7.1, and 7.2!!!] is **also** not a typo! — Thermal Conduction [which is **only** in the lecture notes, not in the textbook!] belongs best right after we talk about equations of state of solids in section*