

Physics 317: THERMODYNAMICS

Spring 2022

The course meets:

Tuesdays, Wednesdays, and Fridays at 9:30 – 10:20 am in Elliott 162.

(If, sometime during the course it becomes necessary to move to online — we of course hope that will never be the case, but if it does — it will be via Zoom at <https://uvic.zoom.us/j/3347938652>.)

Tutorial sessions: Fridays at 1:30 – 2:20 pm in Elliott 061 (with tutorial leader Afif Omar, aaif@uvic.ca).

(If, sometime during the course it becomes necessary to move to online — we of course hope that will never be the case, but if it does — it will be via Zoom at <https://uvic.zoom.us/j/6421365475>.)

Labs will be in Elliott 125 at your scheduled afternoon or evening times.

Fearless leader: [Justin Albert](#)

Office: Elliott 213

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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/155655>

Text (required): Ashley H. Carter, *Classical and Statistical Thermodynamics*, 4th 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:

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. 18 (during class time) -- we'll have a review session (optional but useful) at **TBD** in the usual classroom (Ell 162).

Final date: TBD — review session at **TBD** in the usual classroom (Ell 162).

Grade

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)

*(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*

- 12.4 Helmholtz Free Energy
- 12.5 Gibbs Free Energy
- 12.6 Summary, the Maxwell Relations, and the Gibbs-Helmholtz Relations
- 12.7 The Joule and Joule-Thomson Coefficients
- 12.8 The Thermodynamic Functions for an Ideal Gas
- 12.9 The Thermodynamic Functions for Other Substances
- 12.10 Absolute Entropy
- 12.11 Charging a Battery *
- 12.12 Surface Energy *
- 12.13 Fugacity *

Chapter 13. Expansion, Compression and the TdS Equations

- 13.1 Coefficient of Expansion
- 13.2 Compression
- 13.3 Pressure and Temperature
- 13.4 The TdS Equations
- 13.5 Expansion, Compression and the TdS Equations
- 13.6 Young's Modulus *
- 13.7 Rigidity Modulus (Shear Modulus) *

Chapter 14. The Clausius-Clapeyron Equation

Chapter 15. Adiabatic Demagnetization

- 15.1 Introduction
- 15.2 Adiabatic Decompression
- 15.3 Adiabatic Demagnetization
- 15.4 Entropy and Temperature

Chapter 16. Nernst's Heat Theorem and the Third Law of Thermodynamics

- 16.1 Nernst's Heat Theorem
- 16.2 The Third Law of Thermodynamics

Chapter 17. Chemical Thermodynamics

- 17.1 Equilibrium Constant
- 17.2 Heat of Reaction
- 17.3 The Gibbs Phase Rule
- 17.4 Chemical Potential
- 17.5 The Maxwell Relations
- 17.6 Partial and Mean Molar Quantities
- 17.7 The Gibbs-Duhem Relation
- 17.8 Chemical Potential, Pressure, Fugacity
- 17.9 Entropy of Mixing, and Gibbs' Paradox