

## **Phys 4409: Thermodynamics and Statistical Physics**

### **Winter 2021**

#### **Course aim**

This course is designed to develop an integrated understanding of thermal physics both at the macroscopic (thermodynamics) and at the microscopic (statistical mechanics) levels. The first part of the course focuses on fundamental principles of thermal physics, including the first and second laws of thermodynamics, entropy and free energy. This is followed by statistical mechanics, including Maxwell-Boltzmann and quantum statistics.

#### **Lectures and office hours**

Lecture slots: Tuesdays and **Thursday 11:35-12:55**, course modality: **blended**

Normally, **only the Thursday lecture** will be held **live** via **BigBlueButton** on CU-learn, and be more problem-based. Pre-recorded lectures on the material of the course will be released separately (in place on the Tuesday lecture). Often prior to the live Thursday lectures, a quiz will be due, motivating you to prepare for the lecture so you can better take part in the discussion.

Office hours are on Thursday from 13:20-14:20.

The Thursday “live lecture” will be recorded, so you can watch it later in case you miss it.

Assignments will be due on Friday at midnight.

#### **Instructor and teaching assistant**

Dag Gillberg, [dag@physics.carleton.ca](mailto:dag@physics.carleton.ca)

T.A.: Paul Smith, [paulsmith3@cmail.carleton.ca](mailto:paulsmith3@cmail.carleton.ca)

#### **Textbooks**

**Required reading:** D. Shroeder: An introduction to Thermal Physics, Addison-Wesley, 2000  
ISBN-10 0-201-38027-7 or ISBN-13 978-0-201-38027-9

Additional material might be available as pdf files on the class CUlearn page.

#### **Supplementary material**

- Concepts in Thermal Physics, Second Edition. Stephen J. Blundell and Katherine M. Blundell ISBN: 9780199562107
- Thermal Physics. Ralph Baierlein, Cambridge University Press, 1999
- Thermodynamics, Kinetic Theory, and Statistical Thermodynamics. Francis W. Sears and Gerhard L. Salinger

#### **Prerequisites**

PHYS 3701 (Modern Physics), MATH 2004 and MATH 3705 or permission by the department

## Marking scheme

- Assignments 40%
- Pre-lecture quizzes 5%
- Midterm 15%
- Final exams 25%
- Oral final exam 15%

The pre-lecture quizzes will be due prior to the live lecture on Thursday

## Assignments

An assignment will be due each Friday, for a total of ten assignments. The assignments are posted on the course's CUlearn page with the associated deadline. Late assignments are penalized, unless there is a valid reason (by university standard). You are encouraged to discuss the problems with fellow students, however the work you hand in must be your own. Feel free to consult me or the T.A. if you have problems. Note that the T.A. (Paul) constructs the assignments and will hence be very familiar with the problems. The assignments are a critical part of the course and working through the problems yourself is essential to learn the material. Your homework solutions should be thorough, self-contained and logical with all steps explained.

You **need to produce a single pdf file** of your solution (not several files!) and **upload it to the CU-learn** page. See slides at the top of the CU-learn page for a few pointers on how to achieve this.

## Written exams

The midterm exam will (most likely) be the last lecture before the reading week during the normal lecture slot (80 or 90 min). You will need to produce a pdf and upload it to the CU-learn page, similar to how an assignment is submitted.

The final exam will have two parts: a CU-learn-based online test + a written part. It will take place during the regular examination period at the end of the term. The exact format of the exams will be discussed in advance during the lectures.

## Oral exam

Each student will have an oral exam for about 15 minutes during the last week of classes. This will cover mostly conceptual questions and ask to explain and reason around the concepts of the course.

## Quizzes

Several quizzes will be released throughout the course. Typically they will have about 5 questions and be due before the Thursday lecture (i.e. 11:30 on Thursday). They will be timed at 20 min (or similar). Most questions will be multiple choice, but they might also be "choose one or more options" or simple calculations. Don't forget units!

## Copyright

Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by the instructor and by students, are copy protected and remain the intellectual property of their respective author(s). All course materials, including pdf files and other materials, are also protected by copyright and remain the intellectual property of their respective author(s).

Students registered in the course may take notes and make copies of course materials for their own educational use only. You may not allow others to reproduce or distribute course materials. You may not make your own recordings of lectures or office hours. Students are not permitted to reproduce or distribute course materials publicly for commercial or non-commercial purposes.

## Plagiarism and other forms of cheating

Working through problems is essential in developing understanding of thermal physics. Students are permitted to discuss concepts and strategies related to solving the homework assignments. All work handed in, however, **must be their own**.

Viewing or searching for solutions in any form before your assignment is submitted is forbidden and will be considered an academic offence. This includes online resources like Chegg, solutions manuals, examples posted at Carleton or elsewhere, or from any other type of unauthorized source. Using any such resource for an examination of any kind (laboratory report, assignment, midterm, etc) is considered **plagiarism**, even if only part of the solution is used.

For more information see [Reg. 19 of the Grad calendar](#)

Note that the university policy of penalties for plagiarism is significant:

First offence (2nd-year student or higher): A grade of F in the course.

Second offence: A grade of F in the course and a one-term suspension from studies.

Third offence: Expulsion from the University.

## Deferred exams

Deferred exams are generally only granted to students who cannot take the regularly scheduled exam due to illness.

# University policies

## Grade Definition:

In accordance with the Carleton University Undergraduate Calendar Regulations, the letter grades assigned in this course will have the following percentage equivalents:

A+ = 90-100	B+ = 77-79	C+ = 67-69	D+ = 57-59
A = 85-89	B = 73-76	C = 63-66	D = 53-56
A- = 80-84	B- = 70-72	C- = 60-62	D- = 50-52
F = <50			

WDN = Withdrawn from the course

ABS = Student absent from final exam

DEF = Deferred

FND = (Failed, no Deferred) = student could not pass even with 100% on final exam

Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.

## Academic Regulations, Accommodations, Plagiarism, Etc.:

University rules regarding registration, withdrawal, appealing marks, and most anything else you might need to know can be found on the university's website, here:

<http://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/>

## Academic Integrity

The University Senate defines plagiarism as “presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own.” This can include:

- reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as one’s own without proper citation or reference to the original source;
- submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, or paraphrased material, concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another’s data or research findings;
- failing to acknowledge sources through the use of proper citations when using another’s works and/or failing to use quotation marks;
- handing in “substantially the same piece of work for academic credit more than once without prior written permission of the course instructor in which the submission occurs.”

**Plagiarism is a serious offence** that cannot be resolved directly by the course’s instructor. The Associate Dean of the Faculty conducts a rigorous investigation, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They can include a final grade of “F” for the course.

## **Course Copyright**

Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copyright protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s).

Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).

## **Academic Accommodations**

Text from <https://students.carleton.ca/course-outline/>

Carleton University is committed to providing access to the educational experience in order to promote academic accessibility for all individuals.

Academic accommodation refers to educational practices, systems and support mechanisms designed to accommodate diversity and difference. The purpose of accommodation is to enable students to perform the essential requirements of their academic programs. At no time does academic accommodation undermine or compromise the learning objectives that are established by the academic authorities of the University.

### ***Pregnancy Obligation:***

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website [carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)

### ***Religious Obligation:***

Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit the Equity Services website [carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf](https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf)

### ***Academic Accommodations for Students with Disabilities:***

If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at **613-520-6608** or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. For more details, visit the Paul Menton Centre website <https://carleton.ca/pmc>

- The deadlines for contacting the Paul Menton Centre regarding accommodation for final exams for the Fall exam period is **November 13, 2020** and for the Winter exam period is **March 12, 2021**.

### ***Survivors of Sexual Violence:***

As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: <https://carleton.ca/sexual-violence-support>

### ***Accommodation for Student Activities:***

Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the policy at <https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

### ***Assistance for Students:***

Career Services: <https://carleton.ca/career/>

Academic Advising: <https://carleton.ca/academicadvising/>

Co-operative Education: <https://carleton.ca/co-op/>

Centre for Student Academic Support: <https://carleton.ca/csas/>

Writing Services: <https://www.carleton.ca/csas/writing-services/>

Peer Assisted Study Sessions (PASS): <https://carleton.ca/csas/group-support/pass/>

Math Tutorial Centre: <https://carleton.ca/math/math-tutorial-centre/>

Science Student Success Centre: <https://sssc.carleton.ca/>

### ***Freedom of Information and Protection of Privacy:***

Carleton University is committed to protecting the privacy of those who study or work here (currently and formerly). To that end, Carleton's Privacy Office seeks to encourage the implementation of the privacy provisions of Ontario's *Freedom of Information and Protection of Privacy Act* (FIPPA) within the university.

In accordance with FIPPA, please ensure all email communication with staff/faculty is via your Carleton email account. To get your Carleton email you will need to activate your MyCarletonOne account through Carleton Central. Once you have activated your MyCarletonOne account, log into the MyCarleton Portal.

### ***Important Dates:***

<https://calendar.carleton.ca/academicyear/>

<https://carleton.ca/registrar/registration/dates-and-deadlines/>