Thermal Physics

PHY B52 - Winter 2014

Lecture	Tuesday	1:00 pm - 3:00 pm	MW 262
Tutorial	Wednesday	1:00 pm - 3:00 pm	BV 359

"A theory is the more impressive the greater the simplicity of its premises, the more different kinds of things it relates, and the more extended its area of applicability. Therefore the deep impression that classical **thermodynamics** made upon me. It is the only physical theory of universal content which I am convinced will never be overthrown, within the framework of applicability of its basic concepts."

– Albert Einstein

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Office Hours

Tuesday, Wednesday, Thursday	10:30 am - 12:30 pm	3:30 pm - 4:30 pm
Monday, Friday	9:30 am - 11:30 am	1:30 pm - 3:30 pm
or by Appointment (call or email to schedule)		

Course Description and Requirements

The course will start with the idea of thermal equilibrium; an extension to the concepts of energy, heat, and work; and the definitions of temperature and entropy. We will continue with a study of mechanical and chemical equilibrium; the laws of thermodynamics; and examples and applications to heat engines, refrigerators, free energy, and chemical thermodynamics. We will conclude the course with an introduction to the statistical concepts which underlie macroscopic thermodynamics and provide the bridge between the microscopic and macroscopic pictures, using quantum ideal gases as our example.

By the end of the course you will be able to:

- Identify and define the basic vocabulary used in Thermodynamics and Statistical Mechanics.

- Recognize the connection between the microscopic quantum mechanical description and the macroscopic thermodynamical view of systems composed of large numbers of particles.

- Apply fundamental principles of thermal physics to solve problems and conceptual questions involving both ideal as well as real thermodynamical phenomena.

Course Prerequisites: Intro. to Physics IIA (PHYA21); Calculus of Several Variables I (MATB41)

Course Corequisite: Calculus of Several Variables II (MATB42)

Required Materials

- **Textbook:** *An Introduction to Thermal Physics* by Daniel V. Schroeder (Pearson Education)

ISBN# 0201380277

Use the textbook and the class schedule at the end of this document to prepare **before** each lecture and to work on the questions and exercises that will be the basis of the problem sets and tutorial quizzes.

- **Calculator:** A scientific non-programmable calculator is required.

Grading Scheme - Preliminary

Component	Points	Due Date
Reading Quizzes	5	Ongoing (Pre-Lecture)
Tutorial Work	15	Ongoing (Weekly Tutorials)
Test #1	15	Week 5
Test #2	20	Week 9
Final Examination	45	Exam Period (April 10 - 26)

Grade Components

Reading Quizzes (5%)
Each week on the course website you will be asked a set of questions from the assigned readings for the upcoming week. You will have until **11:55 pm** on Monday to submit your answers. Each quiz is worth **5 points**, and your final grade is the total sum of all quizzes up to a maximum of **50 points**. Use the **Class Schedule** found at the end of this document to prepare for the lectures and reading quizzes.

Tutorial Work (15%)
During our tutorial sessions we will work on your questions and queries regarding the assigned problem sets posted on the course website. We will also work on any difficult points you may have encountered while reviewing the textbook and lecture materials. The assessment of your work will be a combination of tutorial quizzes, group work, blackboard problems, electronic homework, and take-home questions.

Test #1 (15%)
The first test will be scheduled during **Week 5**. Content for the test includes all lecture discussions, textbook readings, and problem sets up to and including the material assigned for Tuesday, January 28.

Test #2 (20%)
The second test will be scheduled during **Week 9**. Content for the test includes all lecture discussions, textbook readings, and problem sets up to and including the material assigned for Tuesday, March 04.

Both tests will be **90 minutes** long and the format includes conceptual multiple-choice and short answer questions as well as detailed problems. The only aids allowed are your non-programmable scientific calculator, and **one** hand-written, double-sided, and letter-sized aid sheet. Please note that photocopies or computer printouts are not allowed.

Final Examination (45%)

The final examination will be scheduled during the exam period of **April 10 - 26**. Content for the final examination includes all the topics discussed in the assigned textbook readings, lecture presentations, problem sets, and tutorial quizzes. The final examination will be **3 hours** long and the format includes conceptual multiple-choice and short answer questions as well as detailed problems. The only aids allowed are your non-programmable scientific calculator, and **one** hand-written, double-sided, and letter-sized aid sheet. Please note that photocopies or computer printouts are not allowed.

Class Policies

In-class Conduct

- Please turn **off** all cellphones, laptop computers, and tablets when you come into the class.

- Class starts at 1:10 pm and ends at 3:00 pm. Late arrival or early departure is inappropriate and disrespectful to your instructor and your peers.

- Do not bring and consume food in the classroom as this creates unwanted distractions that will negatively affect the learning environment.

- Regarding anything that you might want to use in the classroom: if you are not using it to perform a task specifically related to what we are doing in class at that very moment, please put it away.

Absences

In the case of a problem that supports an absence to a tutorial session your grade will be calculated on the basis of all other tutorial work. In the case of a problem that supports an absence to the first test your second test will have its weight increased accordingly. In the case of a problem that supports an absence to the second test your final exam will have its weight increased accordingly. Valid and official supporting documentation must be submitted within **five (5)** business days of the missed tutorial or test.

Name and Student Number

Any work you hand in for credit must clearly indicate your name and student number. Any work you submit that fails to meet this requirement will be penalized with a 10% deduction provided we are able to identify the work as yours. If we are unable to identify the work as yours, no grade will be awarded.

e-mail

If you want to ask a question via e-mail, please first check the electronic forums in the **Discussion Board** of the course website. Quite likely, you are not the only person with that same question, and if that question has already been asked, you will find the answer there. If the question has not been asked, go ahead and post it yourself instead of sending it by e-mail. This way you will also help other students facing the same issue. The forums in the discussion board are monitored regularly by the course instructor and your peers, making it the best way of communicating for various queries of diverse nature.

However, if the electronic forums are not the best place for your query, make sure you send your e-mail from an official **utoronto.ca** address (e.g., your UTmail+ account), as all other addresses will be filtered out automatically. Furthermore, include the code **PHYB52** somewhere in the subject line of your message, to ensure a quicker response time. I reply to e-mails within a period of 24 hours and I rarely reply to e-mails during weekends.

Academic Integrity and Respect for the Academic Endeavor

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's *Code of Behaviour on Academic Matters:*

http://www.governingcouncil.utoronto.ca/policies/behaveac.htm

outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

- In papers and assignments: Using someone else's ideas or words without appropriate acknowledgment; submitting your own work in more than one course without the permission of the instructor; making up sources or facts; obtaining or providing unauthorized assistance on any assignment.

- On tests and exams: Using or possessing unauthorized aids; looking at someone else's answers during an exam or test; misrepresenting your identity.

- In academic work: Falsifying institutional documents or grades; falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the *Code of Behaviour on Academic Matters.* If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see http://www.utoronto.ca/academicintegrity/resourcesforstudents.html).

Course Support

Discussion Board

The course website supports electronic forums useful for questions and discussions on course content, conceptual problems, textbook readings, as well as any issues relating to administrative details of the course such as deadlines, future topics, and scheduling.

Access*Ability*

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the Access*Ability* Services Office as soon as possible. I will work with you and Access*Ability* Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC Access*Ability* Services staff (located in SW302) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or ability@utsc.utoronto.ca

Class Schedule

This schedule is *tentative* and might change during the term in order to accommodate for variations in the lectures in response to performance and feedback from the students.

Some topics might be removed and others added to adjust for variations in the background of the class. Announcements will be made whenever needed.

Please note that it is your responsibility to read the assigned sections and chapters **before** each lecture.

During the lectures we will concentrate on the most important and difficult aspects of the theories and concepts from your textbook readings.

Failing to complete the textbook readings before each lecture will negatively affect your ability to understand and participate in the class discussions.

Dates	Tuesday Lecture 1pm - 3pm	Wednesday Tutorial 1pm - 3pm
Jan. 07 Jan. 08	**Energy in Thermal Physics** Chapter 1: 1 - 2	**Energy in Thermal Physics** Chapter 1: 3
Jan. 14 Jan. 15	**Energy in Thermal Physics** Chapter 1: 4 - 6	**Problem Set # 01** Tutorial #01
Jan. 21 Jan. 22	**The Second Law** Chapter 2: 1 - 3	**Problem Set # 02** Tutorial #02
Jan. 28 Jan. 29	**The Second Law** Chapter 2: 4 - 5	**Problem Set # 03** Tutorial #03
Feb. 04 Feb. 05	**The Second Law** Chapter 2: 6	**Problem Set # 04** Tutorial #04
Feb. 11 Feb. 12	**Interactions and Implications** Chapter 3: 1 - 3	**Problem Set # 05** Tutorial #05
Feb. 18 Feb. 19	**Reading Week** **Reading Week**	**Problem Set # 06** Tutorial #06 (Electronic Homework)
Feb. 25 Feb. 26	**Interactions and Implications** Chapter 3: 4 - 6	**Problem Set # 07** Tutorial #07
Mar. 04 Mar. 05	**Engines and Refrigerators** Chapter 4: 1 - 2	**Problem Set # 08** Tutorial #08
Mar. 11 Mar. 12	**Free Energy** Chapter 5: 1 - 2	**Problem Set # 09** Tutorial #09
Mar. 18 Mar. 19	**Boltzmann Statistics** Chapter 6: 1 - 2	**Problem Set # 10** Tutorial #10
Mar. 25 Mar. 26	**Boltzmann Statistics** Chapter 6: 3 - 7	**Problem Set # 11** Tutorial #11
Apr. 01 Apr. 02	**Quantum Statistics** Chapter 7: 1 - 6	**Problem Set # 12** Tutorial #12