

# Final Course Outline

## Thermodynamics Lecture

### CHEM 234-51

Gregor Kos

September 13, 2019

## 1 Course description

CHEM 234 is an introductory course in Physical Chemistry focusing on thermodynamics, i.e., the transfer of energy (e.g., heat) that accompanies chemical and physical change. Thermodynamics allows for the quantitative evaluation of equilibria and the determination of the direction of natural change. Thermodynamics provides a universal (mathematical) framework to discuss processes as diverse as gas chemistry, phase transitions, electrochemistry... .

Topics covered in this course include the properties of gases, internal energy, enthalpy & the First Law, entropy, free energy & the Second and Third Laws, phase equilibria, simple mixtures and chemical equilibria.

## 2 Course administration

**Instructor:** Gregor Kos, [gregor.kos@concordia.ca](mailto:gregor.kos@concordia.ca)

**Office:** SP-265.20

**Office hours:** Thu, 15:00–17:00, Fri, 11:00–13:00; and by appointment.

**Prerequisites:** CHEM205, 206; PHYS204, 206, 224, 226; MATH 203, 205  
or equivalents for all prerequisite courses.

**Class time:** Thu, 18:00–20:30

**Room:** CC 314 LOY

**Course website:** <http://moodle.concordia.ca> (automatic enrolment)

**Recommended course text:** Peter Atkins and Julio De Paula, Physical Chemistry, Volume 1: Thermodynamics and Kinetics, 11ed, 2018, WH Freeman, ISBN-13: 978-0198817895, ISBN-10: 9780198817895; available in the University Book Store

## 3 Clickers

The iClicker system will be used during lectures and tutorials for discussion questions and short quizzes. **You need to bring your own, registered clicker to lectures. You cannot use the REEF app!** You also need to register your clicker through Moodle. **Clicker usage will start on 9 Sep 2019 in tutorials and 12 Sep 2019 in class.** No accommodations will be made for forgotten clickers.

## 4 Assessment

During the lecture two assignments and one midterm exam will be given. Together with the cumulative final exam and the tutorial (scheduled separately) the the final mark will be calculated:

- Assignments (two, take-home) 10%
- Clickers: 5%
- Midterm (in-class): 25%
- Final (centrally scheduled): 40%
- Tutorial: 20%

**A passing grade for the combined marks of midterm and final is required to pass the course**, i.e., the contribution to the course mark from midterm and final must be at least 33% of the course grade.

**For the midterm and the final exam, a single letter-sized page (one-sided) with notes of any kind is allowed.** Bring your draft to class for practice sessions and update it frequently before the exams. You may use programmable calculators only after a hard reset in front of the instructor before the exam.

Assignments handed in after the posted deadline will receive a 20% deduction. If they are more than a week late, you will receive a grade of zero for the assignment. **Please see me before the deadline or after (with a doctor's note only) for extensions without deductions.**

## 5 Important dates

Date	Event
5 Sep 2019	Classes start
9 Sep 2019	Tutorials start
12 Sep 2019	Vote on the course outline
16 Sep 2019	CHEM 101 seminars start
6 Oct 2019	Deadline to complete CHEM 101 quiz
17 Oct 2019	Deadline Assignment 1
31 Oct 2019	Midterm exam
14 Nov 2019	Deadline Assignment 2
TBD	Final exam

## 6 Attendance

### 6.1 Lecture

**I strongly suggest to attend classes regularly.** To be excused from the midterm (no supplemental) or final examination (as per university regulations), you must present a doctor's note or other suitable official excuse covering the day of the exam. Marks for a missed midterm with an official excuse will be added to the final exam; without excuse a grade of zero will be given for the missed midterm.

## 6.2 Tutorial

**Attendance at the tutorials is mandatory.** For any missed tutorial a doctor's note or other official note for the day of the tutorial is the only acceptable excuse, otherwise zero marks will be given. You must schedule a make-up tutorial within 1 week with the tutorial instructor. If you miss more than one tutorial without a suitable excuse and fail to attend the make-up tutorial, you will get a failing grade for the course.

### **Tutorial times, starting Mon, 9 Sep 2019**

CHEM 234-01T, Mon, 13:15 - 14:30 (CJ1.129)

CHEM 234-02T, Tue, 13:15 - 14:30 (CJ1.129)

CHEM 234-03T, Wed, 13:15 - 14:30 (CJ1.129)

CHEM 234-04T, Thu, 13:15 - 14:30 (CC425)

CHEM 234-51T, Tue, 18:00 - 19:15 (CJ1.129)

## 7 Course content

Chemistry CHEM 234 is an introduction to thermodynamics. The course will closely follow selected topics from Chapters 1–6 of the assigned textbook. In preparation for the course, I strongly suggest to review the following chapters from General Chemistry. Do not forget to extensively practice your problem-solving skills.

- Stoichiometry (Zumdahl, Chapters 3 & 4 )

- Gases (Zumdahl, Chapter 5)
- Thermochemistry (Zumdahl, Chapters 6 & 17)
- Liquids and Solids (Zumdahl, Chapters 10)
- Properties of Solutions (Zumdahl, Chapters 11)
- Chemical Equilibrium (Zumdahl, Chapter 13)

## 7.1 Chapters covered in detail

Chapter 1 – The Properties of Gases (1A and 1C)

Chapter 2 – The First Law

Chapter 3 – The Second and Third Laws

Chapter 4 – Physical Transformation of Pure Substances

Chapter 5 – Simple Mixtures

Chapter 6 – Chemical Equilibrium (6A and 6b)

Any subsections not covered within the above chapters, e.g., Chapter 1B will not be tested on the midterm and final exams. However, you still need to know any prerequisite material covered during the General Chemistry classes.

## 7.2 Preparatory Reading

The recommended sections are preparatory reading; **these sections do not represent all material covered!** Please refer to your lecture notes, as-

signments, practice problems, in-class discussions for the complete material covered.

<b>Content</b>	<b>Preparatory Reading</b>
Introduction to the course	Course outline
Prerequisites and skills to succeed	
The perfect gas	1A & 1B
Real gases	1C
The First Law 1	2A & 2B
The First Law 2	
Thermochemistry	2C
The Second and Third Laws 1	3A & 3B
The Second and Third Laws 2	3A & 3B
Helmholtz and Gibbs energies	3C
Combining the First and Second Laws 1	3D
Combining the First and Second Laws 2	3D
Phase diagrams	4A & 4B
Phase transitions	
Simple mixtures, properties of solutions	5A & 5B
Phase diagrams of binary systems.	5C
Activities	5E & 5F
Chemical equilibrium 1	6A & 6B
Chemical equilibrium 2	6A & 6B

## 8 Plagiarism and other forms of academic dishonesty

The academic code of conduct can be found in section 17.10 of the academic calendar

<http://www.concordia.ca/academics/undergraduate/calendar/current/17-10.html>).

Any form of unauthorized collaboration, cheating, copying or plagiarism found in this course will be reported and the appropriate sanctions applied. The **mandatory seminar** is a clear and fair opportunity to learn what our faculty regards as academic misconduct. Failure to take part in this learning opportunity and thus ignorance of these regulations is no excuse and will not result in a reduced sanction in any case where academic misconduct is observed.

## 9 Mandatory seminar

As part of this course, you are required to

1. Attend a Chemistry and Biochemistry Departmental Seminar on the academic conduct code and the appropriate use of information sources
2. Pass the online quiz associated with this seminar (the passing grade for the quiz is 100%).



**The deadline to take and pass the quiz is**

**Sun, 6 Oct 2019 at 11:55 pm.**

**Note:** This is not the University's quiz you may have been asked to take when you first registered and logged into the myConcordia portal; the one you must take is similar, but graded by the Department of Chemistry and Biochemistry, and you cannot take it until after you have attended the seminar. The aim of this seminar is to clarify the academic conduct code in terms of what practices will be considered unacceptable with regards to work submitted for grading in Chemistry and Biochemistry courses. You are only exempt from repeating the seminar and the quiz, if you have done both in Fall 2014 or more recently [\*], otherwise you are required to repeat both this term. This short seminar (1 hour) will be held at the following times (note that late-comers will not be admitted):

<b>Date</b>	<b>Time</b>	<b>Place</b>
Mon, Sep 16	16:45-17:45	CC 111
Tue, Sep 17	16:45-17:45	CC 308
Tue, Sep 17	20:45-21:45	HB 130
Wed, Sep 18	16:45-17:45	CC 308
Wed, Sep 18	20:45-21:45	HB 130
Thu, Sep 19	16:45-17:45	HC 155
Fri, Sep 20	16:45-17:45	HC 157

As space for each of the seminars is limited by the room size, please sign up to your preferred time. Sign-up sheets are available outside SP 201.01 (Departmental office).

If you do not complete this course requirement, your final grade for the course will be lowered by one full letter grade with an incomplete (INC) notation until such time as this requirement is completed. Please refer to the undergraduate calendar (section 16.3.5) for details on removal of an incomplete notation.

[\*] You are exempt if you can locate your ID in the pdf file located on the Departmental web site (<http://www.concordia.ca/content/dam/artsci/chemistry/docs/Compliance-list.pdf>).