CHEM352: Physical Chemistry I
Syllabus Fall 2020

Instructor: Dr. Mateusz Marianski
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webpage: `marianski-lab.github.io/courses.html`
Lecture: Tue, 2.10-3.25 pm & Fri 2.10-3.25 pm, **Zoom**
Office hours: Monaday, 12.00 - 2.00 pm, **Zoom**

Text: Physical Chemistry
Thomas Engel, Phillip Reid
3^{rd} or 4^{th} edition, Pearson

Supplemental reading: Physical Chemistry: Molecular Approach
John McQuarrie, John Simons
I highly recommend reading this book in addition to the main text. Whereas the treatment of the thermo in this book is very abstract and unapproachable for newcomers, it's dry academic language works great for quantum chemistry (Spring semester).

Slides and notes: Prerecorded lectures will be posted online. Notes and homework problems will be available through Teams and `marianski-lab.github.io/courses.html`

Course Description

The course will discuss behavior or ideal and real gases and introduce law of thermodynamics as well as their application to the properties of solutions and phase equilibra. Elements of statistical mechanics - boltzmann distibution and partition functions will be introduced in the second part of the lecture.

Learning Outcomes

By the end of the semestrer, students will be able to :

- employ basic principles of chemical thermodynamics to describe behavior of substances on a macroscopic scale,
- compute changes of different state functions during processes involving ideal gas, van der Waals gas and real substances,
- discuss equilibrium and transitions between different phases for real substances using quantitative (describe) and qualitative (chemical potentials) approach,
- demonstate a link between macroscopic observables and microscopic molecular structure using statistial mechanics theory.

Furhermore, upon completion of this course, students should have a solid understanding of classical thermodynamics and basic knowledge of statistical thermodynamics which they will be able in future study and/or in career in science or related fields. The course aims at enhancing skills of using mathematics to address complex chemical and physical problems, as well as improve analytical reasoning and problem-solving skills.

Prerequisites

CHEM 24900 and MATH 25000 and PHYS 12100 all with a grade of C or better.
In addition to the offical prerequisites, successful participations in the course requires understanding of variety of mathematical tools, namely logarithms, differential calculus and linear algebra. Review of these topics is up to their interest.

How the class will look like?

The class follows inverted classroom strategy. Each week, on Sunday evening I will publish two sets of four-five prerecorded lectures and respective notes I use during the class. During these lectures I will discuss the material that is covered in the book. Then, instead of regular lectures, I will hold discussion session to work on question regaring the material. These will be problem solving, discussion-oriented time during which we can discuss problems from homework, book or life *etc.* To keep students engaged, some topics will be covered by you. As a rule of thumb, I expect that you will participate in at least in one class each week.

Grading and Exams

Homeworks The lecture is divided into 4 sections. Each section involve one problem set which is worth 20 pts. The due dates are listed in bold in the table.

Exams Each section will be concluded with a 75-minute exam (30 pts). One letter-sized sheet of notes is allowed for the exam. Althou no browser-locking or recording devices will be used, keep in mind that the exam is prepared such that you spend 75 minutes SOLVING the problems so you do not have time to browse the book. After time is up, you will snap a picture of the exam and upload it to the server. There are no makeups for exams (Department policy)

Class involvement The final 50 points will be graded based on your work during the online class.

The grade will be calculated on the basis of a percentage of total points (250 pts). The projected grade lines are:

A : 90.2% - 100.0% / 225 - 250 pts.
B : 80.2% - 90.0% / 200 - 224 pts.
C : 70.2% - 80.0% / 175 - 199 pts.
D : 60.2% - 70.0% / 150 - 175 pts.
F : 0.0 % - 60.0% / $<$ 150 pts.

The full grades are divided into X+, X and X- using $>$x7.4%, x2.6% - x7.4% and $<$x2.4% ranges.

HC statements:

Academic Integrity Statement: "Hunter College regards acts of academic dishonesty (e.g., plagiarism, cheating on examinations, obtaining unfair advantage, and falsification of records and official documents) as serious offenses against the values of intellectual honesty. The College is committed to enforcing the CUNY Policy on Academic Integrity and will pursue cases of academic dishonesty according to the Hunter College Academic Integrity Procedures."
Cheating will be punished as severely as allowed under University guidelines.

ADA Statement: "In compliance with the ADA and with Section 504 of the Rehabilitation Act, Hunter College is committed to ensuring educational access and accommodations for all its registered students. Hunter College's students with disabilities and medical conditions are encouraged to register with the Office of AccessABILITY for assistance and accommodation. For information and appointment contact the Office of AccessABILITY located in Room E1214 or call (212) 772-4857 /or VRS (646) 755-3129."

Hunter College Policy on Sexual Misconduct: "In compliance with the CUNY Policy on Sexual Misconduct, Hunter College reaffirms the prohibition of any sexual misconduct, which includes sexual violence, sexual harassment, and gender-based harassment retaliation against students, employees, or visitors, as well as certain intimate relationships. Students who have experienced any form of sexual violence on or off campus (including CUNY-sponsored trips and events) are entitled to the rights outlined in the Bill of Rights for Hunter College.

a. Sexual Violence: Students are strongly encouraged to immediately report the incident by calling 911, contacting NYPD Special Victims Division Hotline (646-610-7272) or their local police precinct, or contacting the College's Public Safety Office (212-772-4444). **b.** All Other Forms

of Sexual Misconduct: Students are also encouraged to contact the College's Title IX Campus Coordinator, Dean John Rose (jtrose@hunter.cuny.edu or 212-650-3262) or Colleen Barry (colleen.barry@hunter.cuny.edu or 212-772-4534) and seek complimentary services through the Counseling and Wellness Services Office, Hunter East 1123. CUNY Policy on Sexual Misconduct Link: http://www.cuny.edu/about/administration/offices/la/Policy-on-Sexual-Misconduct-12-1-14-with-links.pdf"

Tentative Schedule

Table 1: The list of lectures titles, and respective chaptes in Engel and Reid. The due dates for homework are highlighted in bold.

#	Class/HW due	Day	Lecture	Chapters
L01	08/28/20	F	Fundamental Concepts of Thermodynamics	CH 1
L02	08/01/20	T	q, w, U, H and the First Law of Thermodynamics	CH 2
L03	09/04/20	F	q, w, U, H and the First Law of Thermodynamics	CH 2
L04	09/08/20	T	The Importance of State Functions: U and H	CH 3
L05	09/11/20	F	Thermochemistry I	CH 4
L06	09/15/20	T	Thermochemistry II	CH 4
	09/18/20	F	No class scheduled	—
E01	09/22/20	T	Exam I – Thermo	CH 1-4
L07	**09/25/20**	F	S and the Second and Third Laws of Thermodynamics	CH 5
	09/29/20	T	*Apparently, it's Monday*	—
L08	10/02/20	F	S and the Second and Third Laws of Thermodynamics	CH 5
L09	10/06/20	T	Chemical Equilibrium – I	CH 6
L10	10/09/20	F	Chemical Equilibrium – II	CH 6
L11	10/13/20	T	The properties of real gases	CH 7
L12	10/16/20	F	Phase Diagrams	CH 8
E02	10/20/20	T	Exam II – Free energy, equilibrium and phase diagrams	CH 5-8
L13	**10/23/20**	F	Solutions I: Ideal and Real Solutions	CH 9
L14	10/27/20	T	Solutions II:Ideal and Real Solutions	CH 9
L15	10/30/20	F	Solutions III: Electrolyte Solutions	CH 10
L16	11/03/20	T	Electrochemical Cells, Batteries and Fuel Cells	CH 11
L17	11/06/20	F	Electrochemical Cells, Batteries and Fuel Cells	CH 11
L18	11/10/20	T	Intro to Probability Theory & Boltzmann Distribution	CH 29
E03	11/13/20	F	Exam III – Solutions and electrochemistry	CH 9-11
L19	**11/17/20**	T	Probability Theory & Boltzmann Distribution	CH 30
L20	11/20/20	F	Ensemble and Molecular Partition Functions	CH 31
L21	11/24/20	T	Ensemble and Molecular Partition Functions	CH 31
	11/27/20	F	*Schwarz Freitag*	—
L22	12/01/20	T	Statistical Thermodynamics	CH 32
L23	12/04/20	F	Statistical Thermodynamics	CH 32
L24	12/08/20	T	Discussion about meaning of life	CH 29-32
	12/10/20	F	Reading Day	—
E04	**12/15/20**	T	11.30 - 1.30 Final Exam – StatMech	CH 29-32