

Faculty of Science Course Syllabus (Section A) (revised April 2022)

Department of Chemistry

CHEM 2301

Physical Chemistry I

Fall 2022/23

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

We acknowledge the histories, contributions, and legacies of the African Nova Scotian people and communities who have been here for over 400 years.

Instructor(s):

Lecturer: Dr. Mark Obrovac
Office: Chemistry Building, Room 230
Telephone: 494-4060
E-Mail: Mark.Obrovac@dal.ca
Office Hours: Office Hours are held on Mondays and Wednesdays, 12:05 pm - 1:35 pm in the Chemistry Building, Room 540. Help outside of office hours by appointment only.

Lab Instructor: Dr. Gianna Aleman
Office: Chemistry Building, Room 1051
Telephone: 902-494-3827
E-mail: gianna.aleman@dal.ca

Course delivery: In person

Lectures: Tuesdays and Thursdays, 8:35 am - 9:55 am, Chemistry Building, Room 226.

Laboratories: The laboratory will run weekly, or as scheduled in Chemistry Podium 115.

The **laboratory will start on September 14-16, Room 115P**. For lab days and times, check the schedule in the lab Brightspace site. Each student will complete 8 lab modules over the course of the term.

All aspects related to the laboratory format, expectations, policies, help sessions, and more, can be found in the '**Intro Module: Lab Syllabus**', **available in the lab Brightspace website**. All students are required to complete the 'Intro Module: Lab Syllabus' during the first week of term.

Course Description

The physical principles underlying chemical systems and reactivity are explored, with an emphasis on the forces between molecules and the properties of matter. Principles of thermodynamics are presented, including thermochemistry, entropy and free-energy relationships. Applications include phase equilibria, chemical equilibria, solutions, colligative properties and electrochemistry.

Course Prerequisites

CHEM 1011.03/CHEM 1012.03 or equivalent; MATH 1000.03 or equivalent (grade of C- or better). PHYC 1190.03/PHYC 1290.03 or PHYC 1310.03/PHYC 1320.03 is strongly recommended.

Course Objectives/Learning Outcomes

Upon successful completion of this course, students should have gained a deeper understanding in the phases of matter, phase behaviour and the energetics of phase changes; conservation of energy and the relationship between heat and work with applications to chemistry, and heat engines; entropy and its statistical meaning; conditions for spontaneity of chemical processes; predicting thermodynamic quantities from electrochemical potentials; and the ability to derive thermodynamic quantities.

Course Materials

"Physical Chemistry", 3rd ed. by Gilbert W. Castellan is recommended for this course.

Lecture slides, homework and other materials will be provided on the course Brightspace website. All pre-lab modules and instructions pertaining to the lab will be provided on the lab Brightspace site.

Laboratory Requirements:

- Laboratory manual: CHEM2301 Laboratory Manual is required (University bookstore).
- Safety glasses (CSA Z94-3 or Z87.1) are mandatory in the laboratory.
- Lab coats are mandatory in the laboratory.
- A hard cover notebook is required.
- A USB flash drive is required to store data.

All required materials can be purchased from the Dalhousie bookstore.

Course Assessment

| Component | Weight (% of final grade) / Date |
|----------------------------|---|
| <i>Laboratory</i> | 25% |
| <i>Assignments</i> | 15% <i>assigned regularly, due at the beginning of assigned class</i> |
| <i>Midterm Examination</i> | 20% <i>Thursday, October 27th, in class</i> |
| <i>Final Examination</i> | 40% <i>scheduled by the Registrar's Office</i> |
| <i>Total</i> | <i>100%</i> |

Other course requirements

In order to receive a passing grade a minimum grade of 50% must be obtained on the final exam component, a minimum grade of 50% must be obtained for both the lecture portion and lab portion of the course, and all laboratory experiments must be completed.

As a student in the Department of Chemistry at Dalhousie, and as part of your chemistry laboratory class requirement, you are REQUIRED to complete the following training:

1. WHMIS (Workplace Hazardous Materials Information System) course
2. Chemistry Safety Module
3. Lab map (in-lab activity with the instructor)

For deadline and further details about the mandatory safety training consult the laboratory manual and the lab Brightspace website.

Laboratory exemptions for this course may only be granted to students who have previously passed the laboratory (final laboratory mark $\geq 50\%$) after having done all the experiments, and who are repeating the course within one (1) year following that in which the laboratory credit was initially granted. Students who have reason to believe that they may be exempted from the laboratory must verify this with the lab instructor, Dr. Aleman, within the first week of the laboratory program. If an exemption is granted, the previous laboratory mark will be carried forward. Whether or not you receive an exemption is Dr. Aleman's decision. A student who is denied a laboratory exemption must repeat the laboratory program. Partial exemptions for specific experiments and/or reports will not be granted.

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

| | | | | |
|-------------|------------|------------|---|---------|
| A+ (90-100) | B+ (77-79) | C+ (65-69) | D | (50-54) |
| A (85-89) | B (73-76) | C (60-64) | F | (<50) |
| A- (80-84) | B- (70-72) | C- (55-59) | | |

Course Policies on Missed or Late Academic Requirements

All assignments must be handed in on time. Answers to assignments are posted/discussed in class immediately after assignments are submitted, therefore late work will not be accepted and will receive zero marks. There are no supplemental or make-up assignments, examinations or quizzes in this class. If you are too ill to write a quiz or examination or complete an assignment in this class, please provide a Student Declaration of Absence form, as per the regulations in the University Calendar. A student who is well enough to write a test will not be allowed a re-write. However, if you are ill or experiencing an extreme personal emergency at the time of a test or an assignment, call me (lab phone: 902 494 4060 or call the main office and leave a message) or email me to inform me of the situation. In the case of an excused quiz or assignment, the others will be weighted more heavily. For an excused midterm examination, the marks for the relevant sections of the final exam will be used in place of the missed test mark. Worked solutions and marking schemes for assigned problems and for the term tests will be posted in a glassed-in bulletin board in the hallway of the third floor of the Chemistry Building. Solutions will not be made available electronically. Due to space limitations, each solution set may only be available for a limited time. It is the student's responsibility to check their work against the posted solutions as soon as work is returned to you.

It is each student's responsibility to read her/his Dalhousie email and the Brightspace website.

In the case of a weather-related closure of the University, notification will be provided on Dal Alert, the Dalhousie website and on local radio stations. If a class needs to be cancelled in another emergency, every attempt will be made to contact students via email and/or Brightspace.

No cell phone use (including no texting) in class, please.

Course Policies related to Academic Integrity

Independent work is expected on all homework assignments. Except where indicated, all homework assignments are to be handwritten on paper (i.e. not electronically). Hardcopy homework assignments are to be submitted by uploading scanned copies to the lecture Brightspace web page as a single pdf file.

Course Content Course Content

1. Equations of State and Mathematical Foundations
 - 1.1. Ideal Gas Law
 - 1.2. Kinetic Theory of Gases
 - 1.3. Deviations from Ideal Behaviour
 - 1.4. Fitting Multivariable Equations
 - 1.5. Differentials
2. First Law of Thermodynamics
 - 2.1. Introduction to Thermodynamics
 - 2.2. Energy Enthalpy and Heat Capacity
 - 2.3. Thermochemistry
3. The Second Law
 - 3.1. Thermodynamic Cycles
 - 3.2. Entropy
 - 3.3. Direction of Natural Processes
4. Physical Equilibria
 - 4.1. Thermodynamics of Equilibrium
 - 4.2. Phase Equilibria in Single Component Systems
 - 4.3. Colligative Properties
 - 4.4. Binary Solutions of Volatile Components
 - 4.5. Equilibria Between Condensed Phases
 - 4.6. Electrochemical Equilibria

Faculty of Science Course Syllabus (Section B) (revised April-2022)**Fall/Winter 2022-23***Course name & number*

Please ensure that the following information on [University Policies](#) is available to all students in your course. This document should be sent to students in your course along with your Course Syllabus, Section A, or may be copied into your [Course Syllabus \(Section A\)](#).

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

Statement: <http://www.dal.ca/cultureofrespect.html>

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).

Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)

<https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&chapterid=1&topicgroupid=31821&loaduseredits=False>

University Grading Practices

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Faculty of Science Course Syllabus (Section C) (revised April-2022)**Fall/Winter 2022-23***Course name & number*

Please ensure that the following information on Student Resources is available to all students in your course. This document should be made available to students on the course Brightspace page, or elements may be copied into your [Course Syllabus](#).

Student Resources and Support**Advising**

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: <https://www.dal.ca/faculty/science/current-students/undergrad-students/degree-planning.html>

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

Library: <https://libraries.dal.ca/>

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>

Fair Dealing Guidelines <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

Other supports and services

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness.html

Student Advocacy: <https://dsu.ca/dsas>

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

Biosafety: <https://www.dal.ca/dept/safety/programs-services/biosafety.html>

Chemical Safety: <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

Radiation Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

Scent-Free Program: <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>

Dalhousie COVID-19 information and updates: <https://www.dal.ca/covid-19-information-and-updates.html>