

## Faculty of Science Course Syllabus Department of Chemistry CHEM 2301 (online) - Introduction to Physical Chemistry Fall 2020

#### Instructors

Lectures:	Aaron Kelly	aaron.kelly@dal.ca
Laboratories:	Gianna Aleman – Milan	gianna.aleman@dal.ca

- Lectures: All lecture contents will be available asynchronously through the course website in Brightspace. Synchronous lecture activities: Tuesdays and Thursdays: 8:35am - 9:55am (AST).
- Laboratories: All laboratory contents will be available asynchronously through the laboratory website in Brightspace. The content will be presented in 10 separate Modules that were developed using Articulate Storyline 360, an e-learning-authoring program for instructional designers. The laboratory will run every week, or as scheduled. Each student will complete one introductory module, 5 experiment-based modules and 4 active learning-based modules over the course of the term, for a total of 10 modules.

Schedule: The laboratory will start on September 9. In general, laboratory modules will be released weekly on Wednesdays, and will be due the following Tuesday by midnight (11:59 pm, AST). For more details, please, refer to the full laboratory schedule posted in the Brightspace laboratory webpage.

<u>Live/Synchronous Help Sessions</u> will be held weekly using Microsoft Teams at the following times:

Wednesday: 2:00 - 4:00 pm (AST) Thursday: 1:30 - 3:30 pm (AST) Friday: 2:00 - 4:00 pm (AST)

Sessions involving the discussion of a general topic or concept will be recorded and posted in Brightspace for access at a later time by those in different time zones.

<u>Asynchronous Help Sessions</u> will be held weekly in the Brightspace Discussion Board. Students will be able to post questions related to the lab content in the Brightspace Discussion Board. Questions will be answered by a Teaching Assistant or the Lab Instructor.

- Questions posted before 4:00 pm (AST) Monday to Thursday will be answered within 24 hours.
- Questions posted Friday to Sunday will be answered the following Monday or business day (if Monday is a holiday) before 4:00 pm (AST).

Some lab modules may involve mandatory synchronous laboratory activities that will be scheduled during regular lab hours (i.e., as per Dal timetable). Details will be provided in each individual module.



Tutorials:Optional tutorials for the lecture component will be held synchronously using Microsoft<br/>Teams. Scheduled for selected Tuesdays and Thursdays: 8:35am - 9:55am.

<u>Asynchronous Help Sessions</u> will be held weekly in the Brightspace Discussion Board. Students will be able to post questions related to the lecture content in the Brightspace Discussion Board. Questions will be answered by a Teaching Assistant or the Instructor.

- Questions posted before 4:00 pm (AST) Monday to Thursday will be answered within 48 hours.
- Questions posted Friday to Sunday will be answered by the following Tuesday before 4:00 pm (AST).

## **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) and a grade of C- or better in MATH 1000.03 (or equivalent). PHYC 1280.03/PHYC 1290.03 or PHYC 1300.06 is strongly recommended.

#### **Learning Objectives**

Upon successful completion of this course, students will have the ability to explain and solve problems relating to phase diagrams and phase changes, heat, work, and conservation of energy, derivation and prediction of thermodynamic quantities, and entropy, free energy, and conditions for spontaneity of chemical processes.

#### **Course Materials**

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Suggested Texts: "Physical Chemistry", by Gilbert W. Castellan

"Elements of Physical Chemistry" by Peter W. Atkins

"Physical Chemistry" by Joseph H. Noggle

- Course and Laboratory Brightspace pages (for asynchronous content)
- Microsoft Teams (for synchronous tutorial, review sessions and laboratory help sessions)
- Computer and Internet Connection: regular access to a reliable computer that operates at a good speed and is able to handle a variety of different programs is required. High speed broadband access is highly recommended for an optimal learning experience. While tablets, smartphones or other mobile devices may allow for some completion of coursework (e.g., readings, multimedia, email, discussion board, etc.), they are not guaranteed to work in all areas. Please, ensure you have a PC or Mac based computer available to complete your lecture and lab assignments.
- Software: the software that you will need in this lab is covered by Microsoft Office 365 (Word, Excel, PowerPoint, Outlook and OneNote, etc.), available as a free download through Dalhousie. Current Dal students can download Microsoft Office 365 on up to five desktop or laptop computers. Visit the Information Technology Services (ITS) website to learn how to download Dal software.
- Minimum technical requirements: Windows 8 or 10 (PC) or OS X (Mac).
- Web browser: Firefox, Chrome, Internet Explorer 11 (PC), Safari (Mac). Note that in some instances, you may need to upgrade your Flash or Java versions.



## **Course Assessment**

Component	Weight (% of final grade)	Date (time, if synchronous)		
Assignments				
Assignment 1	7.5	September 24		
Assignment 2	7.5	October 8		
Assignment 3	7.5	October 22		
Assignment 4	7.5	November 19		
Essay	10	November 26		
Test				
Mid-term test	20	October 29 [ Start: 8:55am // End: 9:55am ]		
Lab Component	20			
Final exam	20	Scheduled by Registrar during exam period		

## Laboratory Component Assessment

Each module will be graded according to the following scheme,

	Intro	Module								
Component	Module	1	2	3	4	5	6	7	8	9
_					%					
Navigate Online Content	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Post-lab Assignment	1	1.5	1.5	1.5	1.5	1.5	1.5	4	1.5	2
Module Total (%)	1.25	1.75	1.75	1.75	1.75	1.75	1.75	4.25	1.75	2.25
Laboratory Total (%) to CHEM2301 grade					20	-				

*Please, refer to the laboratory schedule in the Brightspace laboratory web page for release and due dates of modules.* 

#### Other course requirements

To pass the course, students must pass the lab. To pass the lab students must navigate the content of ALL ten laboratory modules, submit the post-lab work (*e.g.*, lab report or post-active learning session assignment) for Modules 1, 2, 3, 4, 5, 6, 7, 8, and 9, and obtain a final laboratory mark  $\geq$  50%, based on the Modules 1 - 9 post-lab work submitted.

Conversion of numerical grades to Final Letter Grades follows the Da	<u>alhousie Common Grade Scale</u>
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<b>A+</b> (90-100)	<b>B+</b> (77-79)	<b>C+</b> (65-69)	D	(50-54)
<b>A</b> (85-89)	B (73-76)	C (60-64)	F	(<50)
<b>A-</b> (80-84)	<b>B-</b> (70-72)	<b>C-</b> (55-59)		



- Assignments are due by midnight (Atlantic time zone, GMT-3:00) on the posted due dates above.

- Late assignments will not be accepted and will be assigned a mark of zero, unless students have made prior arrangements.

- Students are encouraged to work together on the problem assignments. However, collaboration on the essay project, quiz, and final exam is forbidden.

- If a student misses the midterm test or the final examination without notice, there will be no opportunity to write a make-up exam.

- If the **midterm** is missed due to illness or personal emergency, the student must contact the instructor **within 48 hours of the end of the quiz**. In this situation, the score for the final exam will be used in the place of the missing mark.

- If the **final exam** is missed due to illness or personal emergency, the student must contact the instructor **PRIOR TO THE START** of the exam. In this situation, the student may write a make-up final exam on a date **BEFORE** the end of the exam period.

## **Laboratory Policies**

Lab Exemptions: 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 instructor within the first week of the laboratory program. If an exemption is granted, the previous laboratory mark will be carried forward. 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. You must contact Gianna Aleman (gianna.aleman@dal.ca) in order to apply for a lab exemption. Lab exemptions will not automatically be granted.

No lab exemptions will be granted in future years from the remote laboratory program offered in 2020 term.

To pass the course, students must pass the lab. To pass the lab students must navigate the content of ALL ten laboratory modules, submit the post-lab work (*e.g.*, lab report or post-active learning session assignment) for Modules 1, 2, 3, 4, 5, 6, 7, 8, and 9, and obtain a final laboratory mark  $\geq$  50%, based on the Modules 1 - 9 post-lab work submitted.

Students are welcome (and encouraged) to collaborate with any other members of this class to discuss their post-lab assignments. However, the report must exclusively present the results of experimental data individually provided to each student or group. Reports must be submitted individually, except for certain group assignments included in some active learning sessions.

**Feedback:** Post-lab reports/assignments can only be returned to the student once the entire class has completed and submitted their work for that particular Module. Processing of grades will match the time allowed for work completion (*e.g.*, if you were given 1 week to complete your work, grades will be posted one week after work submission; if you were given 2 weeks to compete your work, grades will be posted 2 weeks after work submission, and so on). General feedback will be posted in the laboratory Brightspace website.

**Illness/Emergency policy:** In the event of illness or personal emergency, please notify the instructor (gianna.aleman@dal.ca) within 24 h to discuss possible alternatives.

**Late work policy:** Late work submitted 1-5 school days past the due date will decrease your overall lab mark (out of 20) by 0.1 mark per day up to a maximum of 0.5 marks per module. Late work submitted after



5 school days will not be considered for a grade unless receiving a zero will cause a failing grade in the course. If your late work impacts the outcome of a group work assignment, you will receive a grade of zero in the group grade component of the assignment. Your group will still complete the assignment. Late work due to illness or personal emergency must be accompanied by a declaration of illness; however, illness/emergency does not grant an automatic extension of post-lab work, instead, follow the instructions given in the Illness/Emergency policy.

**Missed Mandatory Synchronous Lab Activities/Illness:** All missed mandatory synchronous lab activities (note: this does not refer to synchronous help sessions) require a declaration of illness. For Modules 1 through 9, if you miss a mandatory synchronous lab activity, you must contact the instructor before the session begins (see Illness/Emergency policy), as your absence may affect group work (your group will still complete the activity). Any data provided to the group to complete the activity will still be shared with the absent partner. Although the absent student is still required to submit any post-lab work associated with this activity on the normal due date, a grade of zero will be given to any component of the assignment that is linked to group participation/discussion in which the absent student did not partake.

## **Lecture Content**

- Topic 1: Gasses Ideal versus Real Topic 2: Viral series Topic 3: The Boyle Temperature Topic 4: Kinetic Theory of Gasses Topic 5: Internal Energy, Heat, and Work Topic 6: Thermochemistry and Hess' Law Topic 7: Heat Capacities Topic 7: Heat Capacities Topic 8: Entropy Topic 9: Free Energy Topic 10: Fundamental equations of Thermo Topic 11: Maxwell's Relations Topic 12: Another look at Entropy
- Topic 13: Another look at Internal Energy Topic 14: The Joule – Thompson Experiment Topic 15: Solutions and Mixtures Topic 16: Chemical Potential Topic 17: Ideal Solutions Topic 18: Real Solutions Topic 19: Chemical Equilibria Topic 20: Phase Transitions Topic 21: Colligative Properties Topic 22: Electrolyte Solutions Topic 23: Electrochemistry - I Topic 24: Electrochemistry - II

## Laboratory Content

The Chem 2301 laboratory program consists of a total of ten modules: Introductory Module – Chem 2301 Remote Laboratory Syllabus Module 1: Calorimetry I – Bomb Calorimetry Module 2: Calorimetry II – Solution Calorimetry Module 3: Calorimetry III – Differential Scanning Calorimetry Module 4: Active Learning Session 1 Module 5: Equilibria in Inclusion Phenomena Module 6: Active Learning Session 2 Module 7: Active Learning Session 3 Module 8: Thermodynamics of an Electrochemical Cell Module 9: Active Learning Session 4 Please, refer to the laboratory schedule in the laboratory Brightspace web page for release and due dates of modules.

**University Policies and Statements** 



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

#### Missed or Late Academic Requirements due to Student Absence

As per Senate decision instructors <u>may not require medical notes</u> of students who must miss an academic requirement, **including the final exam**, for courses offered during fall or winter 2020-21 (<u>until April 30, 2021</u>). Information on regular policy, including the use of the Student Declaration of Absence can be found here: <u>https://www.dal.ca/dept/university\_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html</u>.

#### **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**: <u>https://www.dal.ca/dept/university\_secretariat/academic-integrity.html</u>

#### 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**: <u>http://www.dal.ca/cultureofrespect.html</u>

#### **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) (<u>elders@dal.ca</u>). **Information**: <u>https://www.dal.ca/campus\_life/communities/indigenous.html</u>

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

https://www.dal.ca/academics/important\_dates.html

#### **University Grading Practices**

https://www.dal.ca/dept/university\_secretariat/policies/academic/grading-practices-policy.html

## **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/academic-advising.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: <a href="https://www.dal.ca/campus\_life/academic-support/writing-and-study-skills.html">https://www.dal.ca/campus\_life/academic-support/writing-and-study-skills.html</a> Studying for Success: <a href="https://www.dal.ca/campus\_life/academic-support/study-skills-and-tutoring.html">https://www.dal.ca/campus\_life/academic-support/study-skills-and-tutoring.html</a> Copyright Office: <a href="https://libraries.dal.ca/services/copyright-office.html">https://libraries.dal.ca/campus\_life/academic-support/study-skills-and-tutoring.html</a> Fair Dealing Guidelines <a href="https://libraries.dal.ca/services/copyright-office.html">https://libraries.dal.ca/services/copyright-office.html</a> Fair Dealing Guidelines <a href="https://libraries.dal.ca/services/copyright-office/fair-dealing.html">https://libraries.dal.ca/services/copyright-office.html</a>

## Other supports and services

Student Health & Wellness Centre: <u>https://www.dal.ca/campus\_life/health-and-wellness/services-support/student-health-and-wellness.html</u>

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

**Ombudsperson**: <u>https://www.dal.ca/campus\_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html</u>

#### Safety

Biosafety: <u>https://www.dal.ca/dept/safety/programs-services/biosafety.html</u> Chemical Safety: <u>https://www.dal.ca/dept/safety/programs-services/chemical-safety.html</u> Radiation Safety: <u>https://www.dal.ca/dept/safety/programs-services/radiation-safety.html</u>

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