

Faculty of Science Course Syllabus
Department of Chemistry
CHEM 3301: Quantum Mechanics
Fall 2022

Instructor: Dr. Erin R. Johnson, erin.johnson@dal.ca, Chemistry Building Room 530

Lectures: Tuesdays and Thursdays, 11:35 am – 12:55 pm, LSC Common Area C210

Course Description

The fundamentals and postulates of quantum mechanics are developed from first principles, with applications to illustrative model systems, vibrations, rotations, atoms, and molecules.

Course Prerequisites

- A grade of C- or better in CHEM 2304: Introductory Physical Chemistry II
- MATH 1030: Matrix Theory and Linear Algebra I
- MATH 2001: Intermediate Calculus I
- PHYC 1109/1290: Introduction to Physics or PHYC 1310/1320: Physics in and around you

Course Objectives/Learning Outcomes

At the conclusion of the course, students will be expected to:

- explain connections between quantum-mechanical concepts and chemistry
- solve mathematical problems involving known model systems in quantum mechanics

Course Material

There is no required textbook for this course, as L^AT_EX notes will be provided. However, having a copy of one or more standard quantum chemistry textbooks is strongly recommended. Some resources are

- Donald A. McQuarrie's Quantum Chemistry
- Ira Levine's Quantum Chemistry
- Peter W. Atkins' Molecular Quantum Mechanics
- Andrew Cooksy's Quantum Chemistry and Molecular Interactions

- Thomas Engel's Quantum Chemistry & Spectroscopy
- David J. Griffiths' Introduction to Quantum Mechanics

but any similar text or combination of texts will be beneficial.

Course Assessment

The course grade will be based on a combination of assignments, mid-term tests, and the final exam:

Component	Weight (% of final grade)	Date
Assignments	20%	Assigned weekly
Mid-term Test 1	20%	Tentatively, Oct 18
Mid-term Test 2	20%	Tentatively, Nov 22
Final Exam	40%	To be scheduled

In the event that the final-exam mark is higher than the grade determined as detailed above, then the course grade will be determined solely by the final exam.

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

There is no Brightspace page for this course - all distribution of electronic materials and announcements to students will be by email to the class list.

Assignments will be given roughly weekly, but will not be given during weeks when a mid-term test is held. The assignments will be due on Fridays before 5:00 pm and should be submitted by email to the instructor. Late assignments will not be accepted and will be assigned a mark of zero, unless students have a legitimate excuse and contact the instructor to arrange an extension before the deadline.

In the event that you are sick and cannot write the mid-term tests or final exam as scheduled, you must email me to let me known **before** the test or exam starts. For the mid-term tests, missing one will lead to the other counting for twice the contribution to the final grade, and there will be no opportunity to re-write the test. If both mid-term tests are missed, then the final exam score will count for the full testing component of the grade. If you miss the final exam, you must supply a doctor's note within 48 hours of the end of the exam. You will only be excused from the exam and allowed to write a make-up exam if both the initial email and doctor's note are provided. The make-up exam must be written before the end of the exam period, unless this is impossible due to ongoing illness or injury. In this case, we will agree on a time to write a make-up exam during the winter term.

In event that the instructor is ill or otherwise unable to conduct in-person lectures, the lectures will instead be given virtually via Zoom. We will also transition to Zoom in the event of a significant COVID outbreak.

Use of cellular phones during class is prohibited. Phones must be silenced and put away throughout the lecture.

Course Content

Topics to be covered include:

- Mathematical Review
- The Schrödinger Equation
- Wavefunctions, Operators, and Expectation values
- The Particle in a Box
- The Harmonic Oscillator
- The Rigid Rotor
- The Hydrogen Atom
- Perturbation Theory
- Multi-Electron Atoms
- The H_2^+ Molecule

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://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 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/services-support/student-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

Lab Safety: https://www.dal.ca/content/dam/dalhousie/pdf/dept/safety/lab_policy_manual_2007.pdf

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>