CHEM/ENCH 313: Quantum Mechanics

Fall 2026

Course Information

General Course Information

Course: CHEM/ENCH 313

Course title: Quantum Mechanics

Instructor: Dr. Taleana Huff (she/her) (taleana.huff@queensu.ca)

Office Hours: By appointment, scheduled by email. (Office # 411)

TA: Luca Corneo (luca.corneo@queensu.ca)

Pre-requisites: (CHEM 211/3.0 or CHEM 222/3.0) and (CHEM 224/3.0 or MATH 110/6.0 or MATH 111/6.0* or MATH 112/3.0) and (MATH 120/6.0 or MATH 121/6.0 or [MATH 123/3.0 and MATH 124/3.0]) and (PHYS 104/6.0 or PHYS 106/6.0 or [PHYS 115/3.0 and PHYS 116/3.0] or PHYS 118/6.0). One-Way Exclusion May not be taken with or after PHYS 344/3.0.

Semester and year: Fall 2026

Number of credits: 36 Lecture, 12 Tutorial, 72 Private Study

Learning hours: 120

Modality (on campus, blended, or online): On campus. Occasionally lectures may be posted online for illness or travel.

Classroom location: [redacted]

Tutorial location: [redacted]

Lecture Times:

[redacted]

Tutorial Times:

[redacted]

Classroom accessibility: Please reach out to me with ay accessibility concerns so I can address them.

Course Description

Quantum mechanics provides the fundamental framework for understanding the structure and behavior of atoms, molecules, and materials. This course introduces the principles of quantum

mechanics with an emphasis on applications relevant to chemistry. Beginning with the mathematical tools required to describe quantum systems, students will develop the concepts of wavefunctions, operators, uncertainty, and the Schrödinger equation before applying these ideas to model translational, vibrational, rotational, and electronic motion.
The course explores both exact and approximate solutions to quantum mechanical problems, including the particle in a box, harmonic oscillator, rigid rotor, hydrogen atom, and many-electron atoms. Students will also be introduced to approximation methods, spin, angular momentum, and the quantum mechanical basis of chemical bonding. Throughout the course, connections are made between theory and modern experimental techniques such as spectroscopy, microscopy, and materials characterization, illustrating how quantum mechanics underpins contemporary chemistry, nanoscience, and quantum technologies.
By the end of the course, students will be able to apply the mathematical formalism of quantum mechanics to solve chemically relevant problems, interpret the physical significance of quantum models, and understand how quantum theory explains the electronic structure and properties of atoms and molecules.

Topics

Week	Date	Lecture	Topics	Assessment
1	[redacted]	1	Course introduction, syllabus, Why Quantum? Blackbody radiation, photoelectric effect, atomic spectra	
		2	de Broglie wavelength, matter waves, double-slit experiment	
2		3	Complex numbers, Euler's formula, probability amplitudes	
		4	Wavefunctions, Born interpretation, normalization	
		5	Expectation values and the Postulates of Quantum Mechanics	
3		6	Schrödinger equation	
		7	Particle in a Box I	
		8	Particle in a Box II; uncertainty principle	HW 1 Due
4		9	Operators, eigenvalues, eigenfunctions	
		10	Applications of Particle in a Box; review	

	[redacted]	—	**National Day for Truth and Reconciliation – No Classes**	
5		11	**Midterm 1**	Midterm 1
		12	Differential equations refresher	
		13	Quantum Harmonic Oscillator I	
6		—	**Thanksgiving – University Closed**	
		—	**Fall Reading Week – No Classes**	
		—	**Fall Reading Week – No Classes**	
7		14	Quantum Harmonic Oscillator II	
		15	Vibrational spectroscopy; selection rules	HW 2 Due
		16	Angular momentum and vectors	
8		17	Angular momentum operators	
		18	Rigid rotor	
		19	Rotational spectroscopy; review	
9		20	**Midterm 2**	Midterm 2
		21	Hydrogen atom: Schrödinger equation	
		22	Hydrogen atom orbitals and quantum numbers	
10		23	Time-dependent Schrödinger equation	
		24	Superposition, stationary states, time evolution	
		25	Electron spin and the Pauli principle	HW 3 Due
11		26	Multi-electron atoms and electron configurations	
		27	Variational principle; helium atom	
		28	Perturbation theory; spectroscopy	
12		29	**Midterm 3**	Midterm 3

	[redacted]	30	Born-Oppenheimer approximation; H_2^+; LCAO molecular orbitals	
		31	Molecular orbitals, computational quantum chemistry (Hartree-Fock, DFT overview), modern applications (STM/AFM, TERS, quantum technologies), comprehensive review	
13		—	Optional review / example problems / advanced topic/ catch-up lecture (if needed)	
		—	Optional review / example problems / advanced topic/ catch-up lecture (if needed)	HW 4 Due
		—	Optional review / example problems / advanced topic/ catch-up lecture (if needed)	
14		—	Optional office-hour style review	
		—	Optional office-hour style review	
Exam Period		—	**Comprehensive Final Exam**	**Final Exam**

Course Learning Outcomes

On successful completion of this course, students will be able to:

1. Explain the fundamental postulates and principles of quantum mechanics.
2. Apply quantum mechanical methods to solve model systems relevant to chemistry.
3. Interpret quantum mechanical wavefunctions and calculate physically meaningful observables.
4. Analyze atomic and molecular systems using quantum numbers, angular momentum, and spin.
5. Apply approximation methods to chemically relevant systems.
6. Explain chemical bonding using molecular orbital theory.
7. Relate quantum mechanics to spectroscopic observations and electronic structure.

8. Solve quantitative quantum mechanics problems using appropriate mathematical techniques.
9. Communicate quantum mechanical reasoning effectively using mathematical and scientific notation.
10. Describe how quantum mechanics underpins modern chemistry and contemporary technologies.

Important University Dates

Please visit the Faculty of Arts and Sciences Sessional Dates website for all academic deadlines.

Inclusion

Land Acknowledgement

The territory that Queen's University occupies is included in the Dish with One Spoon Wampum Belt Covenant, an agreement between the Iroquois Confederacy and the Confederacy of the Ojibwe and Allied Nations to peaceably share and care for the resources around the Great Lakes. The Kingston Indigenous community continues to reflect the area's Anishinaabek and Haudenosaunee roots. There is also a significant Métis community as well as First Peoples from other Nations across Turtle Island present here today.

As we explore the natural world through chemistry and quantum mechanics, I hope we also remember the importance of curiosity, humility, respect for different ways of knowing, and our shared responsibility to learn from one another and to care for the communities and environments around us.

Equity, Diversity, and Inclusivity Statement

Diversifying the STEM community makes it powerful, as it can draw from the full range of human creativity and experience. In this class, we will actively work together to counter STEM's historically exclusionary legacy. Every student, regardless of background, identity, or lived experience is welcome here and deserves the opportunity to thrive. You are welcome here.

Equity and inclusion are not boxes to be checked, but ongoing processes of learning, reflection, and action. I am not an expert in social justice or equity studies, but I listen to those who are, regularly update my training when possible, and integrate that learning into my teaching and the classroom environment. Just as lab safety is a continual responsibility in chemistry, so too is the creation of an equitable, inclusive, and accessible learning space. You can expect that I will work to promote this ideal in every aspect of my classroom. Students are similarly encouraged to contribute to a more inclusive scientific community. This could be by participating in outreach, supporting peers, engaging with campus EDIA initiatives, or fostering conversations about mental health, belonging, and equity in STEM.

Building a Classroom Community

University is a place to share, question, and challenge ideas. Each student brings a different set of lived experiences. You can help to create a safer, more respectful classroom community for learners by following these guidelines:

- Make a personal commitment to learn about, understand, and support your peers.
- Assume the best of others and expect the best of them.
- Recognize and value the experiences, abilities, and knowledge each person brings to the course.
- Acknowledge the impact of oppression on other people's lives and make sure your words and tone are respectful and inclusive.
- Encourage others to develop and share their ideas.
- Pay close attention to what your peers say/write before you respond. Think through and re-read what you have written before you post online or send your comments to others.
- Be open to having your ideas challenged and challenge others with the intent of facilitating growth.
- Look for opportunities to agree with one another, building on and intentionally referencing peers' thoughts and ideas; disagree with ideas without making personal attacks, demeaning, or embarrassing others.
- Speak and interact respectfully both in written and oral communication with the professor and your classmates.

I reserve the right as the instructor to remove up to 5% of your annual grade for a lack of professionalism in the above guidelines. Extreme abuse will be assessed for academic integrity violation.

Fostering Accessibility

All of us have a shared responsibility for reducing barriers to learning and fostering accessibility and promoting meaningful inclusion of those with disabilities. The Accessibility Hub at Queen's University's Human Rights & Equity Office offer a host of tutorials that provide us all with practical tips for:

- creating accessible documents, e.g., to submit to your teaching team or share with peers in peer feedback activities/in a presentation,
- emails, e.g., while communicating with group members or your teaching team, and
- meeting practices (e.g., in tutorials/labs/seminars or virtual meetings.

Name/Pronoun

If, for whatever reason, you wish to change how your name appears in onQ and/or on class lists, please follow these steps. You may also use this process to add your pronouns to the appearance of your name.

1. Log into SOLUS.
2. Click on Personal Information tab.
3. Click on the Names tab
4. Click on the Add New Name tab
5. Choose Preferred from the Name Type drop down menu
6. Enter the name you would like to appear in onQ and/or on class lists.
7. Click Save.

Please allow 24 to 48 hours for your name to be registered within the system. If you have further questions or concerns, please contact ITS at Queen's University.

Course Materials & Technologies

Required Course Textbooks

Course Textbooks	Edition(s)	Publisher	For Purchase	Cost	At Queen's Library?
Quantum Chemistry, Donald A. McQuarrie	2nd edition, Viva student edition	Sausalito, Calif. : University Science Books	Amazon Ebay Indigo	$40-60	Yes

Other Required Materials

None

Supplemental Materials

Resource	Resource Type	Access	Cost	Further Information
Introduction to Quantum Mechanics – David J. Griffiths	Other	Find online Purchase from Amazon, Ebay, etc.	$40-100	Additional helpful physics-based intro textbook to quantum.

Many of the slides for this course were inspired by online lectures or resources, which will be cited as appropriate at the bottom of slides and are all free and publicly available resources.

Educational Technologies, Help, Privacy, and Accessibility

This course makes use of the following website(s), program(s), and/or application(s) for specific educational use/purposes: None.

Privacy: Be aware that your independent use of the website(s), programs, and/or application(s) used in this course*, beyond what is required,* is subject to their terms of use and privacy policy. You are encouraged to review the applicable privacy statements before using the site. Please see below.

Accessibility: Queen's University is committed to developing courses that are accessible. For further information on accessibility compliance of the website(s), program(s) application(s) used in the course, please consult the links below.

Software	Use	Support	Privacy	Accessibility
Select.	Select.			
Select.	Select.			
Select.	Select.			
Select.	Select.			
Select.	Select.			
Select.	Select.			

Notice of Recording

Synchronous (live) classes will sometimes be delivered in this course through Zoom and/or Teams, video conferencing platforms supported by the University. Steps have been taken by the University to configure these platforms in a secure manner. Classes will be recorded with video and audio (and, in some cases, transcription) and will be made available to students in the course for the duration of the term. The recordings may capture your name, image or voice through the video and audio recordings. By attending these live classes, you are consenting to the collection of this information for the purposes of administering the class and associated coursework. If you are concerned about the collection of your name and other personal information in the class, please contact the course instructor to identify possible alternatives.

To learn more about how your personal information is collected, used and disclosed by Queen's University, please see the Notice of Collection, Use and Disclosure of Personal Information.

Copyright of Course Material

Course materials created by the course instructor, including all slides, presentations, handouts, tests, exams, and other similar course materials, are the intellectual property of the instructor. It is a departure from academic integrity to distribute, publicly post, sell or otherwise disseminate an instructor's course materials or to provide an instructor's course materials to anyone else for distribution, posting, sale or other means of dissemination, without the instructor's express consent. A student who engages in such conduct may be subject to penalty for a departure from academic integrity and may also face adverse legal consequences for infringement of intellectual property rights.

Communication

Questions about the Course and Contacting the Teaching Team

If you have questions about the course material or administration, please contact the instructor and/or TA directly. Email works best, and every effort will be made to answer the email within a business day of receipt.

Queen's Email

The university communicates with students via Queen's email. Please check your email regularly to ensure you do not miss important information related to your course.

Course Feedback

At various points during the course, you may be asked to take part in a variety of feedback activities, such as surveys and questionnaires. This feedback enables the teaching team to improve the course. All surveys are anonymous and are directly related to activities, assessments, and other course material.

Office Hours

Office hours are by appointment. Please email Dr. Huff to book a time (Taleana.huff@queensu.ca). Dr. Huff also welcomes after lecture discussions provided she doesn't have any scheduling conflicts. Please reserve email questions for personal or private matters. Also note, there will be dedicated office hours scheduled before midterms and finals. Dates/times/locations to be posted in OnQ.

Assessments

Weighting and Alignment with Course Learning Outcomes (CLOs)

Assessment	Topic	Alignment with CLOs	Anticipated Due Date (finalized dates announced in class)	Weighting
Homework 1	Foundations of quantum mechanics, wave-particle duality, wavefunctions, probability, and normalization	1–4, 9	Sept. 23	6%
Midterm 1	Foundations of quantum mechanics, the Schrödinger equation, particle in a box, operators, and the uncertainty principle	1–5, 9	[redacted]	13%

Homework 2	Quantum harmonic oscillator, vibrational spectroscopy, angular momentum, and rigid rotor	3–5, 8, 9	Oct. 20	6%
Midterm 2	Quantum harmonic oscillator, angular momentum, rigid rotor, rotational spectroscopy, and the hydrogen atom	3–5, 8, 9	[redacted]	13%
Homework 3	Hydrogen atom, quantum numbers, electron spin, and the time-dependent Schrödinger equation	3–5, 8, 9	Nov. 11	6%
Midterm 3	Hydrogen atom, multi-electron atoms, approximation methods, and perturbation theory	3–6, 8, 9	[redacted]	13%
Homework 4	Born-Oppenheimer approximation, molecular orbital theory, LCAO, and introductory computational quantum chemistry	6–10	Dec. 1	6%
Final Examination	Comprehensive assessment covering all course material	1–10	December Examination Period	37%
Total				**100%**

Grading

All components of this course will receive numerical percentage marks. The final grade you receive for the course will be derived by converting your numerical course average to a letter grade according to Queen's Official Grade Conversion Scale:

Letter Grade	Grade Points	% Equivalent	Description
A+	4.3	90-100	Exceptional
A	4.0	85-89	Outstanding
A-	3.7	80-84	Excellent
B+	3.3	77-79	Very Good
B	3.0	73-76	Good
B-	2.7	70-72	Reasonably Good
C+	2.3	67-69	Acceptable

Letter Grade	Grade Points	% Equivalent	Description
C	2.0	63-66	Minimally acceptable (Honours)
C-	1.7	60-62	Minimally acceptable (General)
D+	1.3	57-59	Unsatisfactory pass
D	1.0	53-56	Unsatisfactory pass
D-	0.7	50-52	Unsatisfactory pass
F	0.0	<50	Failure - no course credit

Assessment Flexibility

Quantum mechanics is a cumulative subject, and students often develop a deeper understanding of the material as the semester progresses. To recognize this improvement, if a student's final examination percentage exceeds their lowest completed midterm percentage, the final examination percentage will replace that single lowest midterm percentage when calculating the final course grade. The final cumulative exam must be taken and cannot be missed.

Students who miss a midterm due to approved academic consideration will not write a make-up midterm. Instead, the weight of the missed midterm will be transferred to the comprehensive final examination. Because all three midterms must be completed to qualify for grade replacement, students who receive this accommodation are not also eligible for the final-examination grade replacement described above. To be eligible for this accommodation, students are expected to submit their request for academic consideration **before** the scheduled start of the examination whenever reasonably possible. Exceptions may be made in cases of extreme or unforeseen extenuating circumstances, in accordance with Queen's Academic Consideration policies.

Example 1: A student earns 68% on Midterm 1, 81% on Midterm 2, 74% on Midterm 3, and 90% on the Final Examination. Because the student completed all three midterms and the final examination grade exceeds their lowest midterm grade, the 68% on Midterm 1 will be replaced with 90% when calculating the final course grade.

Example 2: A student is ill and receives approved academic consideration and misses Midterm 2. The weight of Midterm 2 (13%) will be transferred to the Final Examination, increasing the Final Examination weighting from 37% to 50%. Because the student did not complete all three midterms, no additional midterm grade will be replaced by the final examination grade.

Homework assignments are intended to provide regular practice with the mathematical and conceptual skills developed throughout the course. To provide flexibility for unforeseen circumstances, each student may use one 72-hour no-questions-asked extension on a homework assignment during the semester. The extension must be requested before the assignment deadline. Additional extensions or accommodations will be considered in accordance with Queen's academic consideration policies.

For information regarding what is considered extenuating circumstances and qualifications for Academic Consideration, please visit the Faculty of Arts and Science's Academic Consideration webpage.

Descriptions of Learning Activities and Assessments

Homework 1

A problem set covering the foundational concepts of quantum mechanics, including wave-particle duality, wavefunctions, probability, normalization, and the mathematical framework required for subsequent topics.

Midterm 1

An in-class written test assessing students' understanding of the fundamental principles of quantum mechanics, including the Schrödinger equation, particle-in-a-box model, operators, eigenfunctions, and the uncertainty principle.

Homework 2

A problem set focusing on the quantum harmonic oscillator, angular momentum, rigid rotor model, and their applications to molecular vibrations and rotational spectroscopy.

Midterm 2

An in-class written test covering the quantum harmonic oscillator, angular momentum, rigid rotor, rotational spectroscopy, and introductory treatment of the hydrogen atom.

Homework 3

A problem set exploring the hydrogen atom, quantum numbers, electron spin, and the time-dependent Schrödinger equation.

Midterm 3

An in-class written test assessing students' understanding of atomic quantum mechanics, many-electron atoms, approximation methods including the variational principle and perturbation theory, and their application to chemically relevant systems.

Homework 4

A problem set introducing molecular orbital theory, the Born-Oppenheimer approximation, the Linear Combination of Atomic Orbitals (LCAO) method, and the foundations of computational quantum chemistry.

Final Exam

A comprehensive, cumulative written examination assessing students' understanding of the principles of quantum mechanics and their application to atoms, molecules, and chemical systems. The examination includes conceptual questions, mathematical derivations, and quantitative problem-solving covering all course learning outcomes.

Proctored Exams

Timing of Final Examinations
Once the exam schedule has been finalized, the exam date will be posted on your SOLUS account. The exam dates for each term are listed on the Faculty of Arts and Science webpage under "Important Dates." Student exam schedules for the Fall Term are posted on SOLUS immediately prior to Thanksgiving and on the Friday before Reading Week for the Winter Term. Students should **delay finalizing any travel plans until after the examination schedule has been posted**. Exams will **not be moved or deferred** to accommodate employment, travel/holiday plans or flight reservations. For information regarding what is considered extenuating circumstances and qualifications for Academic Consideration, please visit the Faculty of Arts and Science's Academic Consideration webpage.

If you are unable to attend an exam and receive approval for a deferred proctored exam, a further deferral of that exam will not be accommodated. Please review the assessment flexibility section for more flexible accommodation options.

Assignments and Submission Policy

Assignments should be uploaded to QnQ by 23:59 on the given due date. It is 100% your responsibility to make sure it is submitted on time and in a format accessible to the instructor. No exceptions. A full letter grade will be deducted from the assignment for each day late, including weekends. The absolute last day to submit a late assignment is 3 days after its due date. Anything past this three-day window will be evaluated as 0%.

Students with letters of accommodation should, if possible, confirm the implementation of their accommodations prior to the listed due dates. Please see the "Accommodations for Disabilities" section of this syllabus for more information.

Students experiencing short-term extenuating circumstances that are beyond their control and may affect their academic work should submit a request to their faculty office for academic consideration. Please see the "Academic Considerations for Students in Extenuating Circumstances" section of this syllabus for more details.

Assignments may be handwritten on paper or completed electronically using a stylus (e.g., on a tablet). Solutions must clearly show all reasoning and intermediate steps. Typed solutions are not permitted unless explicitly authorized.

On all assignments, the clarity and completeness of your reasoning is as important as the final

answer.

To receive full credit, you must:

- Show every algebraic and conceptual step leading to your result
- Include intermediate equations, not just the final expression of number
- Add brief notes explaining what you are doing and why at key steps (these are optional on timed exams).
- Justify any approximations or assumptions you make (still must do on exams)
- Carry all units correctly through each step
- In practice, every line of your solution should either:
- perform a mathematical operator, or
- include a short note explaining the step (these are optional on timed exams)

Unexplained jumps between steps will lose credit, even if the final number is correct. If your final answer is numerically correct but your reasoning is absent, incomplete, or unclear you may be deducted significant points (see below). A correct number without a demonstrated process is treated as incomplete work.

Technical Accuracy (50%)

Assesses whether you used the correct equations, applied them properly, carried units consistently, and arrived at a physically and mathematically valid result.

Grade	Description
50%	Flawless solution, correct equations, correct algebra, correct units, correct final result.
35-45%	Minor algebraic or arithmetic error; underlying method and logic correct.
25-35%	Partially correct method: you identify relevant relationships but misapply them or make a major procedural error.
10-25%	Some relevant equations or fragments of an approach appear, but no coherent progress towards a solution.
0%	Irrelevant work, incorrect approach with no connection to the problem, or no work shown.

Reasoning and Communication (50%)

Assesses how clearly and transparently you present your thought process: intermediate steps, justification of assumptions, explanation of approximations, and logical flow.

Grade	Description
50%	Every step of the solution is shown and clearly explained. Assumptions

	and approximations are identified and justified. The reasoning is easy to follow.
35-45%	Most steps are shown and generally correct, but some explanations are missing or unclear; minor gaps in logic.
25-35%	Evidence of reasoning exists, but key steps are skipped, insufficiently justified, or not clearly connected.
10-25%	Scattered equations or notes with minimal explanations; the reasoning cannot be reconstructed.
0%	Only the final answer is provided, or the work contains no meaningful explanation of how the solution was obtained.

Midterm Tests and Final Exam

Each midterm and the final exam are closed book proctored, with limited reference materials allowed:

- For midterms, you may bring an index card (3x5") with handwritten notes on one side.
- For the final exam you may bring one 8.5x11" piece of paper with handwritten notes on one side.

The use of the Casio 991 series calculator is permitted and is the only approved calculator for Arts and Science students. See "Calculator Policy".

About Exam answers: exams will be assessed using the same Technical Accuracy (50%)/Reasoning and Communication (50%) breakdown as detailed above for HW assignments. However, since exams are in a timed environment, skipping detailed explanation of steps is ok for the sake of timeliness (exceptions detailed in "To receive full credit" above), but I should still be able to follow your logic. Assumptions/approximations must still be justified.

Policy Review of Graded Work

Requests for assessment regrading may be made to your TA a minimum of 48 hours after you have received the marked copy of your assessment, but no more than 10 days later. Be sure to read your TA's feedback carefully before you submit a review of graded work. To request that your assesment be reviewed, please include the following in your email:

- Your name, student number, and TA's name.
- The original copy of your marked assignment, attached.

- Your reason for the request:
    - The specific aspects of your assignment that you believe were not sufficiently awarded, referring to the categories of the rubric.
    - Why you believe that your assignment meets the criteria for a higher mark for each of the categories of the rubric that you indicated above. Please make explicit reference to the detailed descriptions of each category provided in the rubric.

If a review of graded work results in only a slightly different final grade, the original grade will stand. Should we find an error where marks were not assigned when they should have been or were missed in adding up the total score or were added up incorrectly resulting in a higher score than earned, the grade will be changed so that it is accurate. Grades would only increase or decrease if there was evidence of an error in marking, not simply because the regrader interprets or applies the rubric slightly differently than the original grader.

The instructor will have the final say in assigning grades in the course unless a process under the Academic Petitions and Appeals is initiated.

Policies

Class Attendance

Attendance is not mandatory, and I will not take attendance or grade participation. You are adults and I trust you to make decisions about how you manage your time.

That said, quantum mechanics is a cumulative subject. Nearly every lecture builds directly on material from previous lectures, and falling behind can make subsequent topics significantly more challenging. In-class lectures will often include worked examples, problem-solving strategies, conceptual discussions, and demonstrations that may not be fully captured in the lecture slides posted online, nor the textbook.

If you choose to miss a class, it is your responsibility to obtain notes and any announcements from a classmate. I am happy to answer questions about the material during office hours or after class, but I will not reteach missed lectures individually.

Calculator Policy

As noted in Academic Regulation 9.2, “Calculators acceptable for use during quizzes, tests and examinations are intended to support the basic calculating functions required by most Arts and Science courses. This course uses the Casio 991 series calculator, the only approved calculator for Arts and Science students.

Working in Groups

You are permitted to work with a partner or in groups of 3 to encourage collaboration, cooperation, and collective learning. You are not permitted to share complete answers in onQ, or through any other means. You must provide independent answers on the HW's. Your independent work on these, and your collaborative work on the practice questions from the textbook and tutorials, will help you to prepare for the exams which are, again, *a large percentage of your final grade*.

Academic Support

All undergraduate students face new learning and writing challenges as they progress through university: essays and reports become more complex; effectively incorporating research into writing becomes more important; the types of assignments become more diverse; managing your time and developing the skills you need to read and think critically gets more challenging. I encourage students to contact Student Academic Success Services (SASS). SASS offers many different ways to receive support:

- Free online or in-person appointments to get personalized support on writing and academic skills from expert staff and trained peers.
- Workshops and drop-in programs. SASS' Events Calendar lists events coming soon.
- Online resources that provide strategies for academic skills and writing development at university.
- If English is not your first language, SASS has specific resources for English as Additional Language students, including weekly programs and EAL academic skills appointments. You can meet on an ongoing basis with an EAL consultant to work on your academic writing, speaking, listening, and reading skills.

Accommodations for Disabilities

Queen's University is committed to working with students with disabilities to remove barriers to their academic goals. Queen's Student Accessibility Services (QSAS), students with disabilities, instructors, and faculty staff work together to provide and implement academic accommodations designed to allow students with disabilities equitable access to all course material (including in-class as well as exams). If you are a student currently experiencing barriers to your academics due to disability related reasons, and you would like to understand whether academic accommodations could support the removal of those barriers, please visit the QSAS website to learn more about academic accommodations or start the registration process with QSAS by clicking ***Access Ventus*** button at **Ventus | Accessibility Services | Queen's (queensu.ca)**

VENTUS is an online portal that connects students, instructors, Queen's Student Accessibility Services, the Exam's Office and other support services in the process to request, assess, and implement academic accommodations.

To learn more go to: https://www.queensu.ca/ventus-support/students/visual-guide-ventus-students

Academic Consideration for Students in Extenuating Circumstances

Academic Consideration is a process for the University community to provide a compassionate response to assist students experiencing unforeseen, short-term extenuating circumstances that may impact or impede a student's ability to complete their academics. This may include but is not limited to any extenuating circumstance (illness, bereavement, traumatic event, injury, family emergency, etc.) which is short-lived, begins within the term, and will not last longer than 12 weeks - see Academic Consideration webpage for details (https://www.queensu.ca/artsci/undergraduate/student-services/academic-consideration)

> Each Faculty has developed a protocol to provide a consistent and equitable approach in dealing with requests for academic consideration for students facing extenuating circumstances. For more information, undergraduate students in the Faculty of Arts and Sciences should consult the Faculty's webpage on Academic Consideration in Extenuating Circumstances and submit a request via the Academic Consideration Request Portal. Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty.

Students are encouraged to submit requests as soon as the need becomes apparent and to contact their instructor and/or course coordinator as soon as possible once academic consideration has been granted. Any delay in contact may limit the options available for academic consideration. While we encourage instructors to accommodate, each instructor has discretion in deciding whether or how to apply the Academic Consideration. For more information on the Academic Consideration process, what is and is not an extenuating circumstance, and to submit an Academic Consideration request, please see the Faculty of Arts and Science's Academic Consideration website. ASO courses include links to information on **Academic Consideration** on your **Course Homepage** in onQ.

Please see the Teaching Team page for contact information for your instructor and TA(s), where relevant.

For more information, please see the Senate Policy on Academic Consideration for Students in Extenuating Circumstances.

Queen's Policy Statement on Academic Integrity

Queen's University is dedicated to creating a scholarly community free to explore a range of ideas, to build and advance knowledge and to share the ideas and knowledge that emerge from a range of intellectual pursuits. Each core value of academic integrity, as defined in the Senate Academic Integrity Policy, gives rise to and supports the next.

Honesty appears in presenting one's own academic work, whether in the context of an examination, written assignment, laboratory or seminar presentation. It is in researching one's

own work for course assignments, acknowledging dependence on the ideas or words of another and in distinguishing one's own ideas and thoughts from other sources. It is also present in faithfully reporting laboratory results even when they do not conform to an original hypothesis. Further, honesty is present in truthfully communicating in written and/or oral exchanges with instructors, peers and other individuals (e.g. teaching assistants, proctors, university staff and/or university administrators).

Trust exists in an environment in which one's own ideas can be expressed without fear of ridicule or fear that someone else will take credit for them.

Fairness appears in the proper and full acknowledgement of the contributions of collaborators in group projects and in the full participation of partners in collaborative projects.

Respect, in a general sense, is part of an intellectual community that recognizes the participatory nature of the learning process and honours and respects a wide range of opinions and ideas. However, "respect" appears in a very particular sense when students attend class, pay attention, contribute to discussion and submit papers on time; instructors "show respect by taking students' ideas seriously, by recognizing them as individuals, helping them develop their ideas, providing full and honest feedback on their work, and valuing their perspectives and their goals" ("The Fundamental Values of Academic Integrity", 3rd Edition, p. 8).

Ultimately, responsibility is both personal and collective and engages students, administrators, faculty and staff in creating and maintaining a learning environment supported by and supporting academic integrity.

Courage differs from the preceding values by being more a quality or capacity of character – "the capacity to act in accordance with one's values despite fear" ("The Fundamental Values of Academic Integrity", 3rd edition, p. 10). Courage is displayed by students who make choices and integrous decisions that are followed by action, even in the face of peer pressure to cheat, copy another's material, provide their own work to others to facilitate cheating, or otherwise represent themselves dishonestly. Students also display courage by acknowledging prior wrongdoing and taking proactive measures to rectify any associated negative impact.

All of these values are not merely abstract but are expressed in and reinforced by the University's policies and practices.

Artificial Intelligence (AI) Tools Policy

Generative AI tools (e.g., ChatGPT, Claude, Gemini, Copilot) can be valuable learning resources when used appropriately. I encourage you to use them to ask questions, clarify difficult concepts, generate additional practice problems, check your understanding, or point you toward helpful resources. Used this way, AI can be an excellent study aid.

However, AI must not be used to solve or generate solutions for graded homework assignments, nor should it be used to produce work that you submit as your own. The homework assignments are intentionally designed to give you the practice needed to develop the mathematical reasoning and problem-solving skills required for success on the in-class midterms and final examination.

Quantum mechanics is not a subject that can be learned by watching someone else solve problems. Like learning a musical instrument or a new language, proficiency comes from working through problems yourself, making mistakes, and learning from them. While using AI to complete homework may save time in the short term, it often comes at the expense of understanding and typically leaves students underprepared for the in-class assessments, which together comprise 88% of the course grade.

If you become stuck on a homework problem, I encourage you to revisit your notes, consult the textbook, discuss approaches with your classmates, attend office hours, or use AI to help explain concepts—not to produce the solution. Your goal should always be to understand why each step is taken and to be able to reproduce that reasoning independently. Hence the grading scheme for HW's.

I reserve the right to ask students to explain, derive, or justify any submitted work. If a student is unable to demonstrate an understanding of a submitted solution, the work may be subject to grade adjustment and/or further review under Queen's academic integrity policies.

If you are ever unsure whether a particular use of AI is appropriate, please ask. I am happy to discuss acceptable uses of these tools and would much rather answer a question in advance than address concerns after an assignment has been submitted.

Additionally, Queen's Student Academic Success Services (SASS) offers a self-directed, online academic integrity module which we encourage all students to take which will help with:

- Understanding the nature of the academic integrity departure
- Understanding the expectations of and role of sources in scholarly writing
- Integrating sources into your writing (paraphrasing, quoting, summarizing)
- Understanding when and how to cite your sources
- Managing your time effectively to avoid the need for shortcuts
- Taking effective notes to ensure accuracy of source material and correct attribution

Turnitin Statement

This course makes use of Turnitin, a third-party application that helps maintain standards of excellence in academic integrity. Normally, students will be required to submit their course assignments through onQ to Turnitin. In doing so, students' work will be included as source documents in the Turnitin reference database, where they will be used solely for the purpose of

detecting plagiarized text in this course. Data from submissions is also collected and analyzed by Turnitin for detecting Artificial Intelligence (AI)-generated text. These results are not reported to your instructor at this time but could be in the future.

Turnitin is a suite of tools that provide instructors with information about the authenticity of submitted work and facilitates the process of grading. The similarity report generated after an assignment file is submitted produces a similarity score for each assignment. A similarity score is the percentage of writing that is similar to content found on the internet or the Turnitin extensive database of content. Turnitin does not determine if an instance of plagiarism has occurred. Instead, it gives instructors the information they need to determine the authenticity of work as a part of a larger process.

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