

Chemistry 2284B
Physical Chemistry II: Quantum Theory
Winter 2026

Course Outline

1. Course Information

[REDACTED]

[REDACTED]

Prerequisite(s): [Chemistry 1301A/B](#), [Chemistry 1302A/B](#), 0.5 course from Calculus 1000 A/B, [Calculus 1500A/B](#), [Numerical and Mathematical Methods 1412A/B](#), and any other 0.5 course at the 1000-level from Calculus, Applied Mathematics, Mathematics, or Numerical and Mathematical Methods. [Integrated Science 1001X](#) may be used as a substitute for the combination of [Chemistry 1302A/B](#) and [Calculus 1301A/B](#).

Antirequisite(s): [Chemistry 2214A/B](#), the former Chemistry 3374A/B, the former Chemistry 2384B.

Unless you have either the prerequisites for this course or written special permission from the Department of Chemistry to enroll in it, you may be removed and withdrawn from this course in accordance with university policy. This may be done after the add/drop deadline of the academic term, and the course will be marked as withdrawn (WDN) on your academic record. This decision may not be appealed.

2. Instructor Information

[REDACTED]

3. Course Syllabus and Schedule

Course Description: Foundations of the quantum theory of chemical structure and bonding. Topics include chemically relevant model problems of quantum mechanics, elements of atomic and molecular spectroscopy, the relationship between classical and statistical thermodynamics.

Course Topics

1. Wave-particle duality of matter. The wavefunction and its physical interpretation.
2. The Schrödinger equation. Conceptually important model problems of quantum mechanics: particles in potential wells of various shapes. Selection rules for transitions between states. Chemical applications of particle-in-a-box models. The origin of electronic band structure.
3. Quantum-mechanical description of translational, vibrational, and rotational motion. Elements of vibrational and rotational spectroscopy.
4. Operators, eigenfunctions and eigenvalues, quantization of observable physical properties. Quantum superposition, the uncertainty principle.
5. Elements of statistical thermodynamics. Entropy. The Boltzmann distribution, molecular partition functions, calculations of thermodynamic state functions from partition functions.
6. Spin angular momentum. Orbitals and spin-orbitals.
7. Hydrogenic atoms, atomic orbitals, orbital energies, quantum numbers. How quantum mechanics describes the electronic structure of many-electron atoms and molecules.
8. Applications of quantum theory to molecular spectroscopy and photochemistry.

Learning Outcomes

- Scientific principles: Recognition that quantum mechanics provides a theoretical basis for chemistry, materials science, and spectroscopy.
- Theoretical knowledge: Understanding of the key ideas and principles of quantum mechanics such as wave-particle duality, operators, wavefunctions, uncertainty principle, orbitals, etc.
- Practical knowledge: Problem-solving skills in applying the key principles of quantum mechanics to simple problems in chemistry and spectroscopy.
- Awareness of the limitations of the discipline: Recognize the limitations of the models and assumptions used in quantum mechanics as applied to chemistry, being able to illustrate these limitations with specific examples.
- Autonomy and impact: Develop the ability to work productively and to illustrate the relevance of the discipline to chemical research.

4. Course Materials

Complete lecture notes will be made available on OWL: <https://westernu.brightspace.com/>

Recommended textbook: P. Atkins, J. de Paula, J. Keeler, *Physical Chemistry, Volume 2: Quantum Theory*, 12th ed. (Oxford University Press, Oxford, 2023). Cost: \$78 for a 180-day eTextbook License

Students are responsible for checking the course OWL site (<https://westernu.brightspace.com/>) regularly for news and updates. This is the primary method by which information will be disseminated to all students in the class.

If students need assistance with the course OWL site, they can seek support on the [OWL Brightspace Help](#) page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

5. Methods of Evaluation

Grading Scheme and Assessment Dates

The overall course grade will be calculated as listed below:

Test 1	15%	Wednesday, January 28 (in class, open book)
Test 2	15%	Wednesday, February 25 (in class, open book)
Test 3	15%	Wednesday, March 18 (in class, open book)
Final Exam	55%	TBA (multiple choice, closed book)

Assignments. Assignments will be posted throughout the course for practice purposes but will not be collected or graded. The open-book tests will consist of problems analogous to those in the assignments. Students are encouraged to work through the assignments carefully and to use their completed solutions as reference material during tests.

Use of Generative AI Tools

Students may use generative AI tools (e.g., ChatGPT, Copilot, Gemini) as interactive learning aids to support the understanding and reinforcement of course concepts. In particular, the use of such tools to strengthen mathematical background and conceptual comprehension is expressly encouraged. Reliance on generative AI to solve practice homework assignments is discouraged, as it can displace independent problem-solving and undermine preparation for tests and the final examination.

General information about missed coursework

Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs*, posted on the Academic Calendar: https://uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf

Missed tests. Students who miss a test for any reason are not required to apply for academic consideration, submit documentation, or contact the instructor. As an incentive, only tests with a percentage score higher than that of the final examination will count toward the course grade; the weight of all other tests—whether written or missed—will be automatically transferred to the final examination. There are no make-up tests.

When a student misses the Final Exam and their Academic Consideration has been granted, they will be allowed to write the Special Examination (the name given by the University to a makeup Final Exam). See the Academic Calendar for details (under [Special Examinations](#)), especially for those who miss multiple final exams within one examination period.

Fair evaluation. All students will be treated equally and evaluated strictly according to the criteria set out in this course outline. Requests for private or individualized adjustments, including reallocation of assessment weights, additional assessments, special arrangements, or similar accommodations outside established university policies, will not be considered or acted upon.

6. Additional Statements

6.1 Religious Accommodation

When a recognized religious holiday or observance conflicts with an examination, test, or other scheduled academic obligation, students must request accommodation via the University's Student Absence Portal (SAP). This request should identify the conflict and specify which course component(s) (e.g. test, midterm, exam) are affected.

Students are encouraged to submit the SAP request as early as possible, but no later than two weeks before any examination, or one week before any mid-term test or quiz, to allow sufficient time for adjustment.

The SAP request serves as official notification to both the course instructor and the Academic Advising Office, in accordance with University policy:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

The Faculty of Science considers religious accommodations as scheduling conflicts. Instructors should provide either a make-up exam or an earlier sitting of the same exam to accommodate the student.

For more information on recognized religious holidays, please visit the Diversity Calendar posted on the Equity, Diversity & Inclusion website - <https://www.edi.uwo.ca>

6.2 Academic Accommodation Policies

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf.

6.3 General Academic Policies

The website for Registrar Services is <https://www.registrar.uwo.ca/>

Use of @uwo.ca email: In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf, the centrally administered e-mail account provided to students will be considered the individual's official university email address. It is the responsibility of the account holder to ensure that emails received from the University at their official university address are attended to in a timely manner.

Requests for Relief (formerly known as “appeals”)

Policy on Request for Relief from Academic Decision:

https://uwo.ca/univsec/pdf/academic_policies/appeals/requests_for_relief_from_academic_decisions.pdf

Procedures on Request for Relief from Academic Decision (Undergraduate):

https://uwo.ca/univsec/pdf/academic_policies/appeals/undergrad_requests_for_relief_procedure.pdf

6.4 Scholastic Offences

Policy on Scholastic Offences:

https://uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_offences.pdf

Procedures on Scholastic Offences (Undergraduate):

https://uwo.ca/univsec/pdf/academic_policies/appeals/undergrad_scholastic_offence_procedure.pdf

Use of Electronic Devices During Assessments. On *open-book tests*, students may use any course materials, notes, and worked-out assignments stored in an electronic device, provided the device is not a smartphone and is not connected to any network. On the *closed-book final examination*, only non-programmable electronic calculators are allowed. In courses offered by the Faculty of Science, the possession of unauthorized electronic devices is strictly prohibited. This includes, but is not limited to: mobile phones, smart watches, smart glasses, and wireless earbuds or headphones. **During the final examination, the presence of any such device at your desk, on your person, or within reach during an assessment will be treated as a *scholastic offence*, even if the device is not in use.** Only devices expressly permitted by the instructor (e.g., non-programmable calculators) may be brought into the examination room. It is your responsibility to review and comply with these expectations.

Use of generative AI tools (Senate policy). Unless otherwise stated, the use of generative AI tools (e.g., ChatGPT, Microsoft Copilot, Google Gemini, or similar platforms) is **not permitted** in the completion of any course assessments, including but not limited to: assignments, lab reports, presentations, tests, and final examinations. Using such tools for content generation, code writing, problem solving, translation, or summarization—when not explicitly allowed—will be treated as a **scholastic offence**. If the use of generative AI is permitted for a particular assessment, the conditions of use will be specified by the instructor in advance. If no such permission is granted, students must assume that use is prohibited. It is your responsibility to seek clarification before using any AI tools in academic work.

Similarity review of multiple-choice responses. Computer-marked multiple-choice tests and exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

6.5 Support Services

Students who are in emotional/mental distress should refer to Mental Health@Western (<https://uwo.ca/health/>) for a complete list of options about how to obtain help.