



Marshall University Syllabus

College of Science
Department of Chemistry

Course CHM 357 Physical Chemistry: Quantum

Course Description A study of quantum mechanics applied to atomic structure, chemical bonding, and spectroscopy.

Credits 4.00 (undergraduate)

Prerequisites

C or better in all of the following: CHM 212, PHY 211 or 201, and MTH 229

Term/Year Fall 2024

Class Meeting Days/Times

Lecture: MWF 10:00-10:50

Lab: M 1:00- 2:50

Location

Lecture: Science Building 460

Lab: Science Building 460 or 470

Academic Calendar

For beginning, ending, and add/drop dates, see the [Marshall University Academic Calendar](https://www.marshall.edu/academic-calendar/) (URL: <https://www.marshall.edu/academic-calendar/>).

Instructor

Dr. Laura McCunn-Jordan

(call me Dr. McCunn)

Contact Information

- Office: S 466 Masks may be required during in-person office visits.
- Office Hours:
 - Mondays 8:45-9:45 AM (virtually in Teams)
 - Wednesdays 8:45-9:45 AM. virtually in Teams
 - Wednesdays 1:00-3:00 PM, virtually in Teams
 - Fridays 8:45-9:45 AM. in person or virtually in Teams

For virtual office hours, schedule an office hour visit at least 1 hour in advance via Microsoft Bookings:

<https://outlook.office365.com/owa/calendar/DrMcCunnOfficeHours@livemars hall.onmicrosoft.com/bookings/>

If you can't meet during regular office hours or if you need help on short notice, email or call the instructor to request an appointment.

- Office Phone: 304-696-2319
- Marshall Email: mccunn@marshall.edu
- Email is the preferred method of communication and responses can be expected within one business day.

Health and Safety Information

All members of the Marshall University community are expected to always observe health and safety protocols. This includes general health and safety protocols as well as specific protocols that might emerge in response to community and campus health conditions.

Campus Carry Policy

University Policy, UPGA-12 (Campus Carry Policy) derives its authority from West Virginia State law, including the Campus Self-defense Act (W. Va. Code § 18B-4-5b). It pertains to the exercise of Concealed Carry on Marshall University's campus, except in designated areas, by individuals with a valid permit to Conceal Carry.

Individuals who choose to Conceal Carry are responsible for knowing and understanding all applicable federal, state, and local laws and Marshall University Board of Governors Rules, University Policies, and Administrative Procedures. University Policy, UPGA-12 applies to areas of campus and buildings that are directly under the possession or control of Marshall University.

Concealed Handguns are not observable to others and must be holstered and concealed on the body of the permit holder or in a personal carrier, such as a backpack, purse, or other bag that remains under the exclusive and uninterrupted control of the permit holder. This includes wearing the personal carrier with a strap, carrying or holding the personal carrier, or setting the personal carrier next to or within your immediate reach at all times. If your participation in class activities impedes your ability to maintain constant control of your Handgun, please make alternate arrangements prior to coming to class.

Faculty Office

NOTICE: University Policy, UPGA-12 (Campus Carry Policy) defines Sole Occupancy Offices as areas that may restrict Concealed Carry. Please be aware that my office is a Sole Occupancy Office and this statement serves as notice that ***concealed weapons or handguns are not permitted in my office***. If you plan to attend a meeting in my office or to drop by my office, secure your weapon or handgun appropriately before you arrive.

Required and/or Recommended Texts and Materials

Required Texts and Materials

Physical Chemistry, 12th Edition by Atkins and de Paula (consult instructor about older editions)

Composition notebook (stitched binding, not spiral-bound) for lab (reusing an old notebook is permitted)

Indirectly vented chemical safety goggles for lab

Calculator (graphing calculators are allowed in exams; tablets and similar devices with communication capabilities may not be used in exams)

Access to ACS academic lab safety guide (online)

<https://www.acs.org/content/dam/acsorg/about/governance/committees/chemicalsafety/publications/safety-in-academic-chemistry-laboratories-students.pdf>

Recommended/Optional Texts and Materials

Applied Mathematics for Physical Chemistry, 3rd Edition by Barrante

Course Student Learning Outcomes

The table below shows the following relationships: How each student learning outcome will be practiced and assessed in the course.

Student Learning Outcomes	How students will practice each outcome in this course	How student achievement of each outcome will be assessed in this course
Students will understand the limitations of classical mechanics.	<ul style="list-style-type: none">• lectures and readings• review sessions• homework	<ul style="list-style-type: none">• exams
Students will understand the requirements of wavefunctions to satisfy the Schrödinger equation and the Heisenberg Uncertainty Principle.	<ul style="list-style-type: none">• lectures and readings• review sessions• homework	<ul style="list-style-type: none">• exams
Students will apply calculus to solve the Schrödinger equation.	<ul style="list-style-type: none">• lectures and readings• review sessions• homework	<ul style="list-style-type: none">• exams
Students will apply principles of quantum	<ul style="list-style-type: none">• lectures and readings• review sessions	<ul style="list-style-type: none">• exams

mechanics to explain observations in spectroscopy and chemical bonding.	<ul style="list-style-type: none"> • homework 	
Students will understand, interpret, and discuss scientific literature.	<ul style="list-style-type: none"> • journal clubs 	<ul style="list-style-type: none"> • Journal critique questions • special project (student-led journal club)
Students will enhance writing skills and strategies.	<ul style="list-style-type: none"> • short essays in homework and journal clubs • peer-editing of lab reports 	<ul style="list-style-type: none"> • graded lab reports • lab notebook • exams • special project (student-led journal club)
Students will refine oral communication skills.	<ul style="list-style-type: none"> • journal clubs 	<ul style="list-style-type: none"> • special project (student-led journal club)

Writing-Across-the-Curriculum Designation

This course has been designated "WI," or writing-intensive. Throughout the course, students will develop the ability to comprehend the concepts of physical chemistry and interpret them for others through written communication. The following course activities are examples of how students will develop their writing skills this semester.

Exams- approximately 20% of exam content will require written responses (without calculations)

Lab notebook- standards of industry and academia will be reinforced

Journal club- written responses to analytical critique questions

Lab reports- written in the style of research manuscripts

Special project- PowerPoint slides and article summaries will be written to effectively complement the presentations

Course Requirements/Due Dates

Assignments and due dates will be announced in class and posted at Blackboard.

Grading Policy

	Points
Quizzes	90
Lab Notebook	55
Lab Reports	200
Journal Club Critiques	30
In-Class Exams (3)	375
Special Project	100
Final Exam	150

Grading Scale: A 90 -100%, B 80 -89%, C 70 – 79%, D 60 – 69%, F <60%

Final grades are rounded to the nearest whole percent. Late work will not be accepted without an official university excuse or prior arrangement with the instructor.

Attendance/Participation Policy

Attendance for the lecture portion of this class is not mandatory, but highly recommended. Attendance for the laboratory is mandatory. Absences from exams and laboratories can only be accommodated if the absence falls within one of the categories outlined in the undergraduate catalog as an excused absence. COVID-19 related absences will be treated as excused. To make-up an exam or lab, you will need to follow the process for securing an excused absence through the Office of Student Affairs. Prompt notification (no later than next class meeting) that you will be submitting documentation for an excused absence must be provided to the instructor.

Laboratory Policies

1. Students must complete the lab safety training on Blackboard prior to entering the laboratory.
2. Goggles are required at all times during lab.
3. Open-toed shoes, shorts, bare midriffs, etc. are not allowed.
4. Blatant disregard for standard safety practices will result in dismissal from lab.

University Policies

By enrolling in this course, you agree to the University Policies. Please read the full text of each policy (listed below) by going to [MU Academic Affairs: University Policies](https://www.marshall.edu/academic-affairs/policies/). (URL: <https://www.marshall.edu/academic-affairs/policies/>)

- Academic Dishonesty Policy
- Academic Dismissal Policy

- Academic Forgiveness Policy
- Academic Probation and Suspension Policy
- Affirmative Action Policy
- Pre-Finals Week Policy
- D/F Repeat Rule
- Excused Absence Policy for Undergraduates
- Inclement Weather Policy
- Sexual Harassment Policy- Title IX prohibits the harassment of students based on sex, which includes pregnancy, childbirth, and related conditions. This includes that students will not be penalized for taking medically necessary leave related to pregnancy, childbirth, or related conditions. Marshall's Title IX Office may be contacted at TitleIX@marshall.edu
- Students with Disabilities (Policies and Procedures)
- University Computing Services Acceptable Use Policy

Generative Artificial Intelligence (AI) Policy

Students are allowed, and even encouraged, to use Generative AI in some ways but are prohibited from using it in other ways. Keep in mind that any content produced by generative AI can “hallucinate” (produce false information), so students are responsible for ensuring the accuracy of any AI-generated content. For information on citing AI, please see MU Library's citation website (URL: <https://libguides.marshall.edu/plagiarism-AI/cite>) and the American Chemical Society Publications website (URL: https://publish.acs.org/publish/author_guidelines?coden=jpcafh) Students should not use generative AI in any way that would violate the Student Code of Conduct (URL: <https://www.marshall.edu/student-conduct/files/Studnet-Code-of-Conduct-2022.pdf>). Students are permitted and encouraged to use generative AI in the following ways:

Brainstorming: You may use generative AI to stimulate creativity, generate ideas, or brainstorm topics for papers, presentations, and discussions. The generated content must serve as a stepping stone, not a final product.

Citation Assistance: AI tools can be used to manage, format, and organize citations and references, promoting adherence to academic writing standards and specific style guides required for individual assignments.

Grammar and Style Checking: AI-powered writing enhancement tools may be used to help with spelling, grammar, syntax, and stylistic errors.

Concept Understanding: Generative AI can be used to explain or simulate concepts taught in class, aiding in a deeper understanding.

Research Assistance: AI can be used to conduct initial research, compile data, and summarize articles, books, or papers. It should not replace traditional research methods but rather enhance them.

Course Schedule

Week of	Textbook Section	Topic	Lab
8/19	7A-B	Quantum Theory, Wavefunctions	Math Boot Camp
8/26	7B-D	Operators, Translational Motion	Particle-in-a-Box
9/2	7D-E	No class on 9/2. Translational Motion	<i>No Lab, Labor Day</i>
9/9	7E-F	Vibrational and Rotational Motion	Journal Club
9/16	7F, 8A	Rotational Motion, Hydrogen Atoms (Exam 1 on 9/20)	Review Session
9/23	8A-B	Hydrogenic and Multielectronic Atoms	Journal Club
9/30	8C, 9A	Atomic Spectra, Term Symbols, Valence Bond Theory	Atomic Emission Spectra
10/7	9B-C	Valence Bond Theory and Molecular Orbital Theory; No class on 10/11	Computational Chemistry
10/14	9D-E	Molecular Orbital Theory and Polyatomics	Computational Chemistry
10/21	9E, 10A	Polyatomics, Molecular Symmetry (Exam 2 on 10/25)	Review Session
10/28	10B-C, 11A	Group Theory, Symmetry Applications, Spectroscopy	Journal Club and FTIR of HCl and DCl
11/4	11B-E	Rovibrational Spectroscopy	FTIR of HCl and DCl
11/11	11E-G	Electronic Spectroscopy, Excited States	EPR (tentative)
11/18	12A	Magnetic Resonance, EPR (Exam 3 on 11/22)	Review session
<i>November 22 is the last day to drop a full semester individual course.</i>			
11/25		<i>Thanksgiving Break</i>	
12/2	12D	EPR, Special Projects	TBA
12/9	Final Exam at 10:15 AM – 12:15 PM on Monday Dec. 9		