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by appointment
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Chem 324 Lecture: MWF 9:55 – 10:45 AM, Gilman 1104 or via Webex

Course Description/Learning Outcomes: In Chem 324 you will learn how quantum mechanics describes features of nature that classical mechanics cannot by using mathematical and conceptual tools. In addition, you will learn how quantization of energy is manifested in real-world situations, especially spectroscopy and molecular bonding. By the end of the course, you should have a firm grasp on these concepts and how they apply to the world around you. You are responsible for learning, understanding, and applying all subjects and concepts listed in this syllabus and presented throughout the course. Prerequisites for Chemistry 324 include Chem 167 or 178, Math 166. Phys 222 recommended. Chemistry 324 is a 3 credit course. (**attendance is highly recommended; attendance quizzes are a small portion of the overall grade**).

Required Materials:

Textbook: Quantum Chemistry, Second Edition – McQuarrie, University Science Books, 2008. (ISBN: 9781891389504)

Required: **a scientific calculator** (with the functions: $\ln(x)$, e^x , 10^x , y^x) is essential. Graphing calculators are permitted.

Required: **TopHat**. This course will use the Top Hat response system in class and requires the purchase of a license to participate. Visit the TopHat learning tool guide to view the terms of service, privacy policy, accessibility statement, and instructions for joining the Top Hat course and engaging with the Top Hat course. **The TopHat Join Code for 324 is 225529.**

Attendance: Class meets MWF 9:55 am in 1104 Gilman. In-class assessments are part of the grade for the course. **Students may attend class in person (face to face) OR they may join remotely using Webex.** To attend the class remotely, log into the Canvas 324 course, click on either the course calendar or Webex and join. Students using their own device are encouraged to download the Webex application. Remote attendees may ask questions using chat, but are asked to mute themselves during lecture. Remote attendees submit answers using TopHat as if they are present in person.

Online Learning Materials: Throughout the semester, some required course content will be presented online in video recordings. Assessments accompanying these recordings will be equal in weight to a single lecture TopHat Quiz.

Office Hours: all TA and instructor office hours are held in 1101 Gilman AND simultaneously via Webex (join office hours through Canvas as described in the previous paragraph). 1101 Gilman is limited to 5 students and a TA. A facemask and physical distancing is required.

Assignments: Homework assignments (problem sets) will be posted weekly on Canvas. They are due Fridays at 5 pm - no exceptions, no excuses, unless the Dean of Students sends notification that you have a personal emergency. Homework must be submitted as a single pdf file (no photos, do not submit multiple files). (iphones have a camera to pdf converter – visit the following link for instructions: <https://support.apple.com/en-us/HT210336>). On android phones, several free apps are available on GooglePlay (Simple Scanner and Adobe Scan work easily and well). Libraries often have photocopiers with scanning capabilities.

No credit will be received for late homework. Each problem will get a score of 0 (no reasonable attempt), 1 (reasonable attempt, but not correct), or 2 (fully correct) plus **1 point for explaining the significance of the homework question or problem (why do you think that you have been assigned the problem)**; so each problem is worth 3 points. Collaboration is encouraged; feel free to work with other students on the homework, but you must turn in your own individual set of solutions; make certain that what you submit is in your own words and is not the same as anyone you have worked with. Answers to problem sets will be posted after the assignment due date and time. Homework assignments account for 12% of the grade. At the end of the semester, the three lowest homework scores will be dropped (the 11 top scores count towards the final grade). The purpose of this is to allow you to have 3 free passes for when you cannot turn in your homework for unavoidable reasons. No reasons will be accepted for missing more than 3 homework sets. We encourage you to complete and turn in all homework sets, because it is a good way to keep up with the material.

For each homework assignment, the following problem is included as part of the assignment: Create one problem including the solution that would be suitable for inclusion on an exam in this class. Every week the student(s) who write the "best" one or two questions will be awarded 1 extra credit point. Criteria for selection as "best:" 1) Relates the material to a real-world application, 2) Relates a calculation to underlying concepts, 3) Creativity and/or uniqueness, 4) Relevance to material, and 5) Suitability for inclusion on our exams (not too time-consuming, representative of material covered in class, conceptual content)

Note: Illegible exams or problem sets will NOT be graded. All work must be presented reasonably, neatly, and logically; all work MUST be shown. A correct answer without supporting work will receive a score of 0. Problems MUST be listed in the order given on the assignment.

Exams: There will be three one hour exams (each worth 20% of the final grade) and a *comprehensive* final exam (25% of the final grade). Exam dates are listed below and are administered during the normal lecture time in the lecture room – 1104 Gilman.

Exam 1 Wednesday Feb 24 @9:55 am (likely to cover Chapters 1 – 4, MathChapters A, B, & C)

Exam 2 Wednesday Mar 24 @9:55 am (likely to cover Chapters 5 – 7, MathChapters D, E, & F)

1,000,000 point midterm Thursday Apr 1st (covers everything in the universe)

Exam 3 Wednesday Apr 21 @9:55 am (likely to cover Chapters 8 – 10)

Cumulative Final Exam: Wednesday May 5th 9:45 AM (<https://www.registrar.iastate.edu/students/exams/springexams>)

Legal Cheat-sheet: Students may bring a single handwritten notes page or legal cheat sheet to each exam. All information on the page must be handwritten and the paper size must be standard letter (8.5 by 11 inches) or smaller. You may use both sides of the page. Note that all important equations and constants and all needed data will be provided on all of the exams.

All exams, including the final exam, will be retained by the course instructor. Students will have opportunities to view the graded exams.

The ISU final examinations policy will be followed absolutely: <http://www.registrar.iastate.edu/students/exams>. Students who have three or more finals on the same calendar day may request to reschedule a final. The instructor of the course having the smallest number of students is responsible for arranging an alternate examination time for the student unless make-up exam times are available in one of the other courses. Alternative final exam times will only be scheduled for students with a conflicting final exam time or those with three or more finals scheduled for the same days as listed above (and with Chem 324 as their smallest course). **The deadline to request an alternative time for the final exam is 4:30 PM on Friday Apr 23.**

Make-up exams will be administered only in exceptional cases, which must be discussed with the instructor and which absolutely require documentation. In some cases, at the instructor's discretion, in lieu of a make-up exam, the final grade may be comprised of the remaining requirements, each taking on a proportionally higher weighting. **All students (including graduating seniors) MUST take the final exam.**

Regrades on exams or homework assignments: Students have a deadline of **2 weeks** following an exam or homework assignment to request a regrade. Regrade requests must be limited to the correction of errors in grading. After 2 weeks, scores are set.

Grading: The grade will be 12% from problem assignments, 3% from in-class quizzes and exercises and on-line quizzes and self-assessments, 20% from each of the three one hour exams and 25% from the final exam. Plus-minus grading will be used for the final grade. Grades are based upon straight percentages with the following scale. The instructor reserves the right to modify the grading scale. Final grades are not negotiable.

A	A–	B+	B	B–	C+	C	C–	D+	D	D–	F
>93.29	90.0– 93.29	86.7– 89.99	83.3– 86.69	80.0– 83.29	76.7– 79.99	73.3– 76.69	70.0– 73.29	66.7– 69.99	63.3– 66.69	60.0– 63.29	<60.0

Canvas: <https://canvas.iastate.edu/> Canvas will be used for posting of scores and grades and will be central to disseminate information (such as lecture notes and problem sets) and announcements for the class. It is the student's responsibility to check posted grades for accuracy. Any student who discovers an error in a grade on Canvas **MUST** bring the graded work to the attention of a teaching assistant or the course instructor **within 2 weeks** of submission of the work.

In addition, the discussion capability is available for discussion among the students, instructor, and TAs. This communication forum will be monitored and civil language and discussion is expected. **To encourage collaborative learning, extra credit will**

be awarded to students who post helpful answers to questions. Students can earn 0.1% extra credit for each time they correctly and appropriately answer a question. The maximum amount of extra credit that can be earned is 2% (corresponding to 20 posts to answering a question from a student). Extra credit will be awarded only for students who answer peer questions correctly and helpfully (without simply giving the answer). In essence we are offering to pay you to help out your fellow students and to help yourself learn the material better - so please take advantage of this opportunity.

Classroom etiquette: It is expected that you will respect your fellow students and the instructor during the class. People who text, read newspapers, carry on extended conversations during class, or engage in other distracting behavior, will be asked to leave. If attending class remotely, be polite and respectful in chats and mute yourself.

Illness or other emergencies: If you have a health issue or other emergency that requires you to miss multiple classes, you are advised to contact the Dean of Students Office (<http://www.dso.iastate.edu/sa>) and your academic adviser to keep them informed of your situation. See page 4 of the syllabus for COVID-19 guidelines. If you cannot attend class in-person due to quarantine or a minor illness, you do not need to contact the instructor: you may always attend remotely (except for exams).

Right to Privacy: The Federal Right-to-Privacy Act (FERPA) prohibits the instructor from public disclosure of exam scores. You may obtain your exam scores in person from your TAs or the course instructor or using the online grade book. The instructor and the TAs are prohibited from giving grades over the phone or e-mail. Instructors and TAs are not permitted to discuss a student's academic performance with anyone other than the student, their academic adviser, or ISU staff or faculty who have need of this information; Faculty, including TAs, may not discuss academic performance with a student's relatives, friends, or potential employers.

Order of Events:

Introduction & Overview

Ch 1: The Dawn of the Quantum Theory

MathCh A: Complex Numbers

Ch. 2: The Classical Wave Equation

MathCh B: Probability & Statistics

Ch 3: The Schrödinger Equation and a Particle in a Box

MathCh C: Vectors

Ch 4: The Postulates and General Principles of Quantum Mechanics

MathCh D: Series and Limits

Ch 5: The Harmonic Oscillator and Vibrational Spectroscopy

MathCh E: Spherical Coordinates

Ch 6: The Rigid Rotor and Rotational Spectroscopy

MathCh F: Determinants

Ch 7: The Hydrogen Atom

MathCh G: Matrices

Ch 8: Approximation Methods

MathCh H: Matrix Eigenvalue Problems

Ch 9: Many Electron Atoms

Ch 10: The Chemical Bond: One- and Two-Electron Molecules

Ch 11: Qualitative Theory of Chemical Bonding

Ch 12: The Hartree-Fock-Roothan Method

Important Dates in the Semester

Jan 29:	Last day to drop a course and not appear on permanent record. Last day to change schedules using AccessPlus
Feb 5:	Last day to audit a course. An audit does not count towards full-time student status
Feb 24:	Exam 1
Mar 1 - 12:	Mid-term evaluations administered on Class Climate
Mar 19:	2:15 p.m. – Mid-term reports due (C, D, F grades are reported)
Mar 24:	Exam 2
Apr 1:	1,000,000 point midterm exam
Apr 2:	Last day to drop a course or withdraw without extenuating circumstances
Apr 16 - 30:	End of semester course evaluations administered on Class Climate
Apr 21:	Exam 3
Apr 23:	Last day to request an alternate time to take the final exam in case of conflicts
April 26-30	Prep week
May 5:	Final exam Wednesday 9:45 AM (https://www.registrar.iastate.edu/students/exams/springexams)

SYLLABUS STATEMENTS ON SAFETY, BEHAVIOR, RESPECT, AND UNIVERSITY POLICIES

COVID-19 health and safety requirements

Students are responsible for abiding by the university's [COVID-19 health and safety expectations](#). All students attending this class in-person are required to follow university policy regarding health, safety, and face coverings:

- wear a cloth face covering in all university classrooms, laboratories, studios, and other in-person instructional settings and learning spaces. Cloth face coverings are additionally required to be worn indoors in all university buildings, and outdoors when other people are or may be present where physical distancing of at least 6 feet from others is not possible. Students with a documented health or medical condition that prevents them from wearing a cloth face covering should consult with [Student Accessibility Services](#) in the Dean of Students Office.
- ensure that the cloth face covering completely covers the nose and mouth and fits snugly against the side of the face.
- practice physical distancing to the extent possible.
- assist in maintaining a clean and sanitary environment.
- not attend class if you are sick or experiencing symptoms of COVID-19.
- not attend class if you have been told to self-isolate or quarantine by a health official.
- follow the instructor's guidance with respect to these requirements. Failure to comply constitutes disruptive classroom conduct. Faculty and teaching assistants have the authority to deny a non-compliant student entry into a classroom, laboratory, studio, conference room, office, or other learning space.

These requirements extend outside of scheduled class time, including coursework in laboratories, studios, and other learning spaces, and to field trips. These requirements may be revised by the university at any time during the semester.

In accordance with university policy, instructors may use a face shield while they are teaching as long as they are able to maintain 8 feet of physical distance between themselves and students during the entire instructional period. Some form of face covering must be worn at all times in learning spaces regardless of the amount of physical distancing.

Faculty may refer matters of non-compliance to the Dean of Students Office for disciplinary action, which can include restrictions on access to, or use of, university facilities; removal from university housing; required transition to remote-only instruction; involuntary disenrollment from one or more in-person courses; and other such measures as necessary to promote the health and safety of campus.

It is important for students to recognize their responsibility in promoting the health and safety of the Iowa State University community, through actions both on- and off-campus. The university's faculty asks that you personally demonstrate a commitment to our [Cyclones Care campaign](#). Iowa State University's faculty support the Cyclones Care campaign and ask you personally to demonstrate a commitment to our campaign. Your dedication and contribution to the campaign will also protect your family, classmates, and friends, as well as their friends and families. Our best opportunity for a successful semester with in-person learning and extramural activities requires all of us to collaborate and fully participate in the Cyclones Care campaign.

Academic Dishonesty

Academic Integrity, based on the values of honesty, trust, fairness, respect, and responsibility, is a fundamental principle of scholarship in higher education. Iowa State's Academic and Research Misconduct Policy prohibits: plagiarism (using another person's writing or copying any work without proper citation); falsification; unauthorized collaboration during a test or on an assignment or substitution for another student to take an exam, course or test; and other forms of academic dishonesty. If you are to benefit from this class and be properly evaluated for your contributions, it is important for you to be familiar with and follow Iowa [State's Academic Dishonesty and Research Misconduct policies](#). Students are also encouraged to review these [Student Resources](#). Work that violates this policy will not be tolerated. Students who are found responsible for a violation of the Academic Misconduct Policy will

have both a university process sanction and an academic outcome that could include a failing grade on the assignment or exam, or a failing grade for the course.

The class will follow Iowa State University's policy on academic dishonesty. Anyone suspected of academic dishonesty will be reported to the Dean of Students Office: <https://www.studentconduct.dso.iastate.edu/academic-misconduct>

Accessibility Statement

Iowa State University is committed to assuring that all educational activities are free from discrimination and harassment based on disability status. Students requesting accommodations for a documented disability are required to work directly with staff in Student Accessibility Services (SAS) to establish eligibility and learn about related processes before accommodations will be identified. After eligibility is established, SAS staff will create and issue a Notification Letter for each course listing approved reasonable accommodations. This document will be made available to the student and instructor either electronically or in hard-copy every semester. Students and instructors are encouraged to review contents of the Notification Letters as early in the semester as possible to identify a specific, timely plan to deliver/receive the indicated accommodations. Reasonable accommodations are not retroactive in nature and are not intended to be an unfair advantage. Additional information or assistance is available online at www.sas.dso.iastate.edu, by contacting SAS staff by email at accessibility@iastate.edu, or by calling 515-294- 7220. Student Accessibility Services is a unit in the Dean of Students Office located at 1076 Student Services Building.

Usability, disability and design

I am committed to creating a course that is inclusive in its design. If you encounter barriers, please let me know immediately so that we can determine if there is a design adjustment that can be made or if an accommodation might be needed to overcome the limitations of the design. I am always happy to consider creative solutions as long as they do not compromise the intent of the assessment or learning activity. You are also welcome to contact the Student Accessibility Services (515-294-7220) to begin this conversation or to establish accommodations for this or other courses. I welcome feedback that will assist me in improving the usability and experience for all students.

Prep Week

This class follows the Iowa State University Prep Week policy, as noted in the ISU Policy Library and section 10.6.4 of the Faculty Handbook. (<https://www.provost.iastate.edu/faculty-and-staff-resources/faculty-handbook>).

Discrimination and Harassment

Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3410 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515-294-7612, Hotline 515-294-1222, email eooffice@iastate.edu.

Mutual respect and professionalism:

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Your comments to others should be factual, constructive, and free from harassing statements. You are encouraged to disagree with other students, but such disagreements need to be based upon facts and documentation (rather than prejudices and personalities). It is the instructor's goal to promote an atmosphere of mutual respect in the classroom. Please contact the instructor if you have suggestions for improving the classroom environment. It is preferable if students discuss issues directly with the instructor, however, students may also leave a note in the instructor's mailbox.

Religious Accommodation

Iowa State University welcomes diversity of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic requirement conflicts with religious observances and practices. If that happens, students may request reasonable accommodation for religious practices. In all cases, you must put your request in writing. The instructor will review

the situation in an effort to provide a reasonable accommodation when possible to do so without fundamentally altering a course. For students, you should first discuss the conflict and your requested accommodation with your professor at the earliest possible time. You or your instructor may also seek assistance from the Dean of Students Office at 515-294-1020 or the Office of Equal Opportunity at 515-294-7612.

Free Expression

Iowa State University supports and upholds the First Amendment protection of [freedom of speech](#) and the principle of [academic freedom](#) in order to foster a learning environment where open inquiry and the vigorous debate of a diversity of ideas are encouraged. Students will not be penalized for the content or viewpoints of their speech as long as student expression in a class context is germane to the subject matter of the class and conveyed in an appropriate manner.

Name, gender identity and/or gender expression:

Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me accordingly early in the semester so that I may make appropriate changes to my records.

Promoting student health and wellness

- Iowa State University is committed to proactively facilitating the well-being of all students. We welcome and encourage students to contact the following on-campus services for assistance regarding their physical, intellectual, occupational, spiritual, environmental, financial, social, and/or emotional needs:
- Student Wellness call (515) 294-1099 or via the website (<http://studentwellness.iastate.edu>);
- Thielen Student Health Center call (515) 294-5801 (24/7 Medical Advice) or via the website (<http://www.cyclonehealth.org>);
- Student Counseling Services call (515) 294-5056 or via the website (<https://counseling.iastate.edu>);
- Recreation Services call (515) 294-4980 or via the website (<http://recservices.iastate.edu>).
- Students dealing with heightened feelings of sadness or hopelessness, thoughts of harm or suicide, or increased anxiety may contact the ISU Crisis Text Line (Text ISU to 741-741) or contact the ISU Police Department (515) 294-4428.

Fostering a safe community

Green Dot Project: A green dot is any choice, behavior, word or attitude that promotes safety for everyone and communicates utter intolerance for power-based personal violence in our Iowa State University community. A green dot is anything you do to make our community safer. What is your Green Dot? Visit the Green Dot – Student Wellness website (<http://www.studentwellness.iastate.edu/greendot/>).

ISU's Principles of Community

Students are responsible for living the tenets established in ISU's Principles of Community: Respect, Purpose, Cooperation, Richness of Diversity, Freedom from discrimination, and the Honest and respectful expression of ideas. Visit ISU's Principles of Community website (<http://www.diversity.iastate.edu/principles-of-community>)

Contact Information for Academic Issues

If you are experiencing, or have experienced, a problem with any of the above issues, please email academicissues@iastate.edu (This email address for contact information is monitored and answered through the Office of the Senior Vice President and Provost.)

Academic Success Center.

We support. You succeed! The Academic Success Center (Dean of Students Office) provides learning opportunities for all students through services that support academic skill development, grade improvement, and engagement with peers, all of which promote success and self-directed learning. The ASC offers individualized and group-facilitated experiences connected to a specific course, or focus on general skill development. Services include [Academic Coaching](#), [Resources and Worksheets](#), [Supplemental Instruction](#), [Tutoring Services](#), the [Workshop Series](#), and [PSYCH 131, an academic skills course](#). The ASC encourages students to use the supports that can best

strengthen their learning. Learn more about ASC services, employment opportunities, office location, via our the [Academic Success Center website \(http://www.asc.dso.iastate.edu\)](http://www.asc.dso.iastate.edu), call 515-294-6624, or email success@iastate.edu.