

**Instructor:** Dr. Joe Burnett  
**Office:** 1608 Gilman Hall  
**Phone:** 294-7815  
**Section 1:** MWF 8:50 - 9:40 am, Gilman 1051  
**Section 2:** MWF 9:55 - 10:45 AM, Gilman 1051  
**Office Hours:** M 1:30 – 3:30 PM, R 3 PM - 5 PM, and by appointment  
**Office hour location:** 1101 Gilman  
**E-mail:** [joechem@iastate.edu](mailto:joechem@iastate.edu)  
**Pronouns:** He/Him/His

<b>Teaching Assistants:</b>	Hayley Masching	Paul Oftedahl
<b>Office hour location:</b>	1101 Gilman	1101 Gilman
<b>Office Hours:</b>	W 12-1 pm & R 1-3 pm	R 10-12 am & F 12-1 pm
<b>E-mail:</b>	<a href="mailto:hayleym@iastate.edu">hayleym@iastate.edu</a>	<a href="mailto:oftedahl@iastate.edu">oftedahl@iastate.edu</a>
<b>Pronouns:</b>	She/Her/Hers	He/Him/His

**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 Chem 324 include Chem 167 or 178, Math 166. Phys 222 recommended. Chemistry 324 is a 3-credit course. **(Attendance is highly recommended; attendance quizzes and activities represent a 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: Top Hat.** This course will use the Top Hat response system in class and requires the purchase of a license to participate. Visit the Top Hat 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 351669.**

**Office Hours:** all TA and instructor officer hours are held in 1101 Gilman.

**Attendance:** In-class assessments using Top Hat are part of the grade for the course. Top Hat exercises make up 5% of the final grade. At the end of the semester, a minimum of the lowest 5 Top Hat scores will be dropped. This policy gives students the flexibility to miss up to five classes without impacting their overall grade. **Students may attend either section of the class (or both sections!).**

**Assignments:** Homework assignments will be posted weekly on Canvas. **Each assignment is broken into 2 parts: Homework Quizzes** on Canvas and **Problem Sets. Both parts of assignments are due Fridays at 5 pm** - no exceptions, no excuses. (The only exception is if the Dean of Students Office sends notification that you have a personal emergency.)

**No credit will be received for late assignments – late submissions of online quizzes or problem sets will not be graded.**

**Homework Quizzes:** This part of each assignment consists of routine calculations and/or conceptual questions and are delivered through Canvas. Generally, there is no partial credit for these questions. Homework quizzes account for 5% of the grade at the end of the semester. At the end of the semester, the three lowest homework quiz scores will be dropped (the 12 top scores count towards the final grade).

**Problem Sets:** **Problem sets are handwritten (or typed) solutions to questions that are submitted on Canvas as a CLEAN and CLEAR PDF.** (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 (Adobe Scan and Simple Scanner work easily and well). Libraries generally have photocopiers with scanning capabilities.

**Grading of problem sets:** Each question on a problem set 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. Answers to

problem sets will be posted after the class when the assignment is due. The problem assignments account for 10% of the grade. At the end of the semester, the three lowest problem set scores will be dropped (the 12 top scores count towards the final grade).

*The purpose of dropping the three low scores on homework quizzes and problem sets is to allow you to have 3 free passes for when you cannot turn in your homework on time. **We encourage you to complete and turn in all homework sets, because it is a good way to learn and keep up with the material. Students who submit all 15 homework sets AND score better than 60% on all of them will have 5% added to their overall problem set score.***

**For EVERY problem set, 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. Photo submissions of problem sets will not be graded (problem sets must be submitted as legible PDFs). 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. Solutions to problem sets 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 (20% of the final grade). Exam dates are listed below. **Exams are administered on Tuesday evenings from 6:45 – 8 pm in Coover 2245.**

**Exam 1 Tuesday Feb 21 (likely to cover Chapters 1 – 4, MathChapters A, B, & C)**

**Exam 2 Tuesday Mar 28 (likely to cover Chapters 5 – 7, MathChapters D, E, & F)**

**Exam 3 Tuesday Apr 25 (likely to cover Chapters 8 – 10, maybe 11 & 12)**

**Final Exam: Section 1 T 5/9 @ 7:30 AM, Section 2 W 5/10 @ 7:30 AM (cumulative)**

**Legal Cheat-sheet:** (AKA Quick Reference Card) You will be provided with a card-stock legal cheat sheet for use on all exams and quizzes. You may write anything on the document with one rule - **it must be handwritten in non-erasable INK.** You may use both sides of the page. Instructors & your TA may make spot checks throughout the semester. If you lose your cheat sheet, you will NOT receive a replacement; however, each exam will contain a periodic table and all needed data, equations, and constants, so losing the card stock version will only mean you lose access to your notes. Producing a replacement or using pencil or erasable ink to subvert these rules constitutes academic misconduct. **All needed equations and constants and 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.**

**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). There will be no exceptions. **The deadline to request an alternative time for the final exam is 11 am on Friday Apr 28 at 11 am.**

**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 grades are determined as follows: 10% from problem sets, 5% from online homework quizzes, 5% from in-class Top Hat exercises and on-line self-assessments, 20% from each of the three one-hour exams and 20% 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 you 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 in extra credit to help out your fellow students and to help yourself learn the material better - so please take advantage of this opportunity.

**Illness or emergencies:** If you have a health issue or 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.

### Order of Events (tentative):

Introduction & Overview	MathCh E: Spherical Coordinates
Ch 1: The Dawn of the Quantum Theory	Ch 6: The Rigid Rotor and Rotational Spectroscopy
MathCh A: Complex Numbers	MathCh F: Determinants
Ch. 2: The Classical Wave Equation	Ch 7: The Hydrogen Atom
MathCh B: Probability & Statistics	MathCh G: Matrices
Ch 3: The Schrödinger Equation and a Particle in a Box	Ch 8: Approximation Methods
MathCh C: Vectors	MathCh H: Matrix Eigenvalue Problems
Ch 4: The Postulates and General Principles of Quantum Mechanics	Ch 9: Many Electron Atoms
MathCh D: Series and Limits	Ch 10: The Chemical Bond: One- and Two-Electron Molecules
Ch 5: The Harmonic Oscillator and Vibrational Spectroscopy	Ch 11: Qualitative Theory of Chemical Bonding

### Important Dates in the Semester

Jan 23:	Last day to drop a course and not appear on permanent record. Last day to change schedules using AccessPlus
Jan 30:	Last day to audit a course. An audit does not count towards full-time student status
<b>Feb 21:</b>	<b>Exam 1 @ 6:45 pm in Gilman 1352</b>
Feb 27-Mar 10:	Mid-term evaluations administered on Class Climate
Mar 10:	2:15 p.m. – Mid-term reports due (C-, D, F grades are reported)
Mar 13-17	Spring Break (no classes)
<b>Mar 28:</b>	<b>Exam 2 @ 6:45 pm in Gilman 1352</b>
Mar 31:	Last day to drop a course or withdraw without extenuating circumstances
<b>Apr 1:</b>	<b>10<sup>5</sup>-point midterm examination</b>
Apr 21-May 5:	End of semester course evaluations administered on Class Climate
<b>Apr 25:</b>	<b>Exam 3 @ 6:45 pm in Gilman 1352</b>
<b>Apr 28:</b>	<b>Last day to request an alternate time to take the final exam in case of conflicts</b>
May 1-5:	Prep Week (formerly known as Dead Week)
<b>May 9:</b>	<b>Cumulative Final Exam Section 1 (MWF 8:50 – 9:40) 7:30 AM Tuesday May 9</b>
<b>May 10:</b>	<b>Cumulative Final Exam Section 2 (MWF 9:55 – 10:45) 7:30 AM Wednesday May 10</b>

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

### Accessibility Statement

Iowa State University is committed to advancing equity, access, and inclusion for students with disabilities. Promoting these values entails providing reasonable accommodations where barriers exist to students' full participation in higher education. Students in need of accommodations or who experience accessibility-related barriers to learning should work with Student Accessibility Services (SAS) to identify resources and support available to them. Staff at SAS collaborate with students and campus partners to coordinate accommodations and to further the academic excellence of students with disabilities. Information about SAS is available online at [www.sas.dso.iastate.edu](http://www.sas.dso.iastate.edu), by email at [accessibility@iastate.edu](mailto:accessibility@iastate.edu), or by phone at 515-294-7220. **Students with academic accommodations MUST communicate with the course instructor.**

### 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.

### 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 the 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 (<https://www.studentassistance.dso.iastate.edu/>) at 515-294-1020 or the Office of Equal Opportunity, (<https://www.eoc.iastate.edu/>) at 515-294-7612.

### 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](mailto:eooffice@iastate.edu).

### Prep Week

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

### Public Health

If you are not feeling well, please stay home and focus on your health. Should you miss class due to illness, it is your responsibility to work with your instructor to arrange for accommodations and to make up coursework, as consistent with the instructor's attendance policy. **Public health information for the campus community continues to be available on Iowa State's public health website. All public health questions should be directed to [publichealthteam@iastate.edu](mailto:publichealthteam@iastate.edu). COVID-19 Information (Thielen Student health Center): <https://health.iastate.edu/covid-19-information/>**

### Classroom etiquette, mutual respect and professionalism

You are expected to treat your instructor and all other participants in the course with courtesy and respect. Please refrain from distracting behavior during class (talking, texting, watching videos, etc.). 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.

### 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.
- Wellbeing resources for students: <https://www.cyclonehealth.iastate.edu/wellbeing-resources/>
- 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.

### **Academic Dishonesty**

The class will follow Iowa State University's policy on academic misconduct (5.1 in the Student Code of Conduct). Students are responsible for adhering to university policy and the expectations in the course syllabus and on coursework and exams, and for following directions given by faculty, instructors, and Testing Center regulations related to coursework, assessments, and exams. Anyone suspected of academic misconduct will be reported to the Office of Student Conduct in the Dean of Students Office: <https://www.studentconduct.dso.iastate.edu/academic-misconduct/armfacultystaff>. Information about academic integrity and the value of completing academic work honestly can be found in the Iowa State University Academic Integrity Tutorial: <https://iastate.pressbooks.pub/academicintegrity/>.

### **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.

### **Contact Information for Academic Issues**

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