The University of Iowa  
The College of Liberal Arts and Sciences  
Spring, 2023

Title of Course: CHEM 4432 Quantum Mechanics and Chemical Kinetics
Instructor: Dr. James Shepherd, E435 CB, 319-335-0336  
james-shepherd@uiowa.edu
Lecture: MWF 8:30-9:20 am, 134 TH
Discussion: M 4:30 - 5:20 pm or T 9:30 - 10:20 am, 224 NH
Department of Chemistry: chem.uiowa.edu
DEO: Len MacGillivray, E331 CB, 319-335-1350  
len-macgillivray@uiowa.edu

Course ICON site: To access the course site, log into Iowa Courses Online (ICON)  
https://icon.uiowa.edu/index.shtml using your Hawk ID and password. A calendar of course 
assignments and exams is posted under the “Course Schedule” page on ICON.

Quick guide for emails:

<table>
<thead>
<tr>
<th>To...</th>
<th>Email...</th>
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<tbody>
<tr>
<td>Request a make up exam</td>
<td>Fill out this form and, to confirm, email: <a href="mailto:chemistry-center@uiowa.edu">chemistry-center@uiowa.edu</a></td>
</tr>
<tr>
<td>Send in an SDS letter of accommodation (LOA)</td>
<td><a href="mailto:james-shepherd@uiowa.edu">james-shepherd@uiowa.edu</a> and <a href="mailto:chemistry-center@uiowa.edu">chemistry-center@uiowa.edu</a></td>
</tr>
<tr>
<td>Ask a question or Report an absence or anticipated absence</td>
<td><a href="mailto:james-shepherd@uiowa.edu">james-shepherd@uiowa.edu</a> and <a href="mailto:gabriel-j-smith@uiowa.edu">gabriel-j-smith@uiowa.edu</a></td>
</tr>
<tr>
<td>Let us know about a classroom concern</td>
<td><a href="mailto:james-shepherd@uiowa.edu">james-shepherd@uiowa.edu</a></td>
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Student drop-in hours:

<table>
<thead>
<tr>
<th>Individual</th>
<th>Location</th>
<th>Time</th>
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<tbody>
<tr>
<td>Dr. James Shepherd</td>
<td>E435 CB</td>
<td>Wed 1:00 pm – 2:30 pm Or by appointment</td>
</tr>
<tr>
<td></td>
<td>Zoom</td>
<td>Mon 3:00 pm – 4:30 pm Or by appointment</td>
</tr>
<tr>
<td>Gabriel Smith</td>
<td>E208 CB</td>
<td>Tues 1:30 pm – 2:30 pm Fri 11:30 pm – 12:30 pm</td>
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</table>
Learning objectives

Physical chemistry is the study of the interaction and transfer of energy and matter. Being a chemist requires that you can describe interatomic bonding and intermolecular interactions in terms of the fundamentals of quantum mechanics. Detailed learning objectives are provided for every class on the ICON home page.

Course Description

Topics covered by this course include a basic primer on essential quantum mechanics, models for molecular energy level transitions, spectroscopy, the hydrogen atom, electron spin, and molecular orbital theory. We will also conclude the semester with the kinetic theory of gases.

The course is intended primarily for chemistry, biochemistry, environmental science, and chemical and biochemical engineering majors. The course requires limited use of differential and integral calculus and skill in mathematical problem solving.

This course is challenging predominantly because it requires you to interpret diagrams and mathematical expressions in varying contexts to extract new concepts that you have not seen before. In practice, you do this almost every day, but it’s rare to be asked to do this explicitly in a classroom/coursework setting. Reading out information from abstract representations is an information processing skill rather than one of technical/mathematical fluency and must be practiced. We have taken care in this course to separate practicing the process skill from the technical one. Our goal through this course will be to facilitate the learning of information processing and other process skills which will allow you to succeed in class, in the homeworks/exams of this course, and in your future career.

Textbook/Materials:


Course Organization:

This course has been designed and organized to help you learn physical chemistry, but no course or instructor can learn for you. Learning is something only you can do.

Important policies:

- Attendance: Classroom attendance is extremely important for this class and is your most efficient route to learn the material for the exams. This is reflected in the grading structure for this course.
- **Workbook:** We require that you physically write in the POGIL workbook (listed below) in every class. Please ensure you have this by the first lesson.
- **Email policy:** To facilitate instruction, we will answer emails as a team. In general, we will answer emails during or immediately after our office hours. For chemistry-related questions, you will generally need to book appointments or come during office hours.
- **Use of ICON/Gradescope:** Participation in this class requires you to check ICON regularly for updates to homework and announcements. You are invited to contact the instructors if you have any problems or concerns about this. Gradescope will also be used.
- **Roles:** Class roles are assigned on a rotating basis to support equal participation of all students in group activities.
- **Office hours:** Students are invited to drop by during these hours to discuss questions about the course material or concerns. I am also available by appointment if you are unable to attend my office hours.

**Lectures:**

Lectures will be conducted in a guided inquiry format. Virtually all of the activities in class will involve teamwork. Part of your responsibility for this course is to assist the other members of your group (and the entire class) in understanding the material.

Teaching-assistant led discussion classes are designed to support the lectures and consist of:
- Introductory/review/applied/extension worksheets
- Computer-aided visualization activities
- Quizzes

We do **not** generally run review sessions.

**Homework:**

The homework consists of three parts:
- **Pre-activity questions** will be assigned for most lessons. These should take no longer than 15-20 minutes, and will be taken in for grading during the next lesson. These should be brought to class in person.
- **Exercises** (longer problem sets) will also be provided once a week.
  - Since problem solving is a very important aspect of this course, these provide opportunities for you to practice applying your knowledge and help you determine which material you do not understand well.
  - Homework problems to be turned in and graded will be assigned approximately weekly throughout the semester.
  - We anticipate that these are to be turned in on Gradescope.
- **Critical thinking questions** will also be added to other assignments as needed to assist with the progress of the course through the material.
The homework deadlines are set and homework is graded with the following philosophy:

- We want you to come to class equally prepared as other students.
- It is in your best interest to keep up with the homework deadlines in this course as homework offers you a way to check your progress in learning the material.
- It is not necessary to get a perfect score in homework to achieve any grade in the course.

We want you to put in a good faith effort to hand in homework on time because it allows us to grade your work in a careful and fair way. However, events will come up over the course of the semester. In addition to the absence policy outlined here, you will have:

- The chance to turn in three assignments late (by one class period) with no penalty. These apply automatically from an unexcused absence or missed deadline. The number of late assignments you have “used” will be visible in ICON.
- The chance to turn in any assignment, for which the above does not apply, at any time up to the date of the next exam for 50% credit.

Exams:

There will be three 90-minute midterm exams and a cumulative final for this course. Exams provide an opportunity for you to demonstrate your knowledge of the material and let me know what students have mastered and where the problem areas are.

Grade scale:

Grades will be determined by classroom activities, homeworks, performance on three midterm exams, and a cumulative final exam. **We believe the variety of assessment methods will improve your ability to learn in this course.** Final grades will include +/- grades. Those grades will not necessarily be evenly split among the three categories. The College and EPC has recommended that the A+ grade be omitted altogether.

Grades will be earned in approximately the following distributions, depending on where the learning objectives are best assessed:

- Class activities (incl. attendance, discussion, class participation/activities, quizzes as needed, pre-activity questions, workbook completion etc.) ~25-33%
- Exercises (longer problem sets) ~25-33%
- Hour exams, final exam ~33-50%

Due to the weightings given above, the ICON gradebook may not reflect your overall performance in the course. You are invited to come to office hours to discuss grading concerns.
No quizzes or exams will be given in the final week of instruction prior to finals week. Midterm exam dates are set on MyUI at the start of semester with the final date posted when they are confirmed by the registrar’s office.

For those students aiming for a C grade or above:

- We expect you to participate in every class, every discussion section, complete every homework, and problem set. Here, engaging with the practice of physical chemistry is more important to us than the mastery you obtain in the content knowledge.
- A lower grade boundary of 65% is anticipated for the C-/C/C+ grade range.

For those students aiming for grades A and B, in addition to the standard set forward by the statement above:

- We will award an A-grade to indicate a mostly complete mastery of the learning objectives for this course and a B-grade to indicate partial mastery.
- A lower grade boundary of 85% is anticipated for an A-/A grade and a lower grade boundary of 75% is anticipated for the B-/B/B+ grade range.

Expectations for grades are based on degree of mastery of course content. Students may vary in their competency levels on these abilities. Students can expect to acquire these abilities only if they honor all course policies, attend class meetings regularly, complete all assigned work in good faith and on time, and meet all other course expectations.

**Students whose achievement is in the indicated ranges will not receive a grade lower than that regardless of the distribution.** No limit is placed on the number or percentage of students who can attain each grade.

**Grade appeals:**

If you have a dispute over grading, you will need to wait 24 hours after the grade comes back, then you have 7 days to raise a dispute. You will need to raise this dispute in person at office hours or using Gradescope if this feature is available for that assignment.

**Attendance Policy:**

Attendance at all lecture sessions is expected and attendance records are maintained. Legitimate reasons for absences are accepted and when possible prior notice of expected absences is expected. In the case of an excused absence, homework will not be accepted late accompanied by the form below.

As soon as you know that you will be absent for a class, report this to the instructors and then fill out the following form:

https://clas.uiowa.edu/sites/default/files/ABSENCE%20EXPLANATION%20FORM.pdf
We will follow the CLAS policy regarding documentation which can be found here: 
https://clas.uiowa.edu/faculty/student-attendance-and-absences#absences-short-term-illness

**Prerequisites and Required Background Material:** The prerequisites for this course include 
calculus and elementary physics. I will make every effort to introduce important mathematical 
and physical concepts before we need them, but these elements are an essential part of 
physical chemistry. You will be expected to apply the necessary mathematical methods 
including multivariable calculus to be successful in this course.

**Expected Student Workload:** This is a 3 credit hour course, so under University policy you 
should expect to spend a minimum of six hours per week outside of class on activities related to 
this course.

**Use of Syllabus:** Every care has been taken in the construction of this syllabus. A draft syllabus is 
placed for review on ICON and considered final after the first week of semester. Thereafter, the 
policies, procedures and assignments in this course may change due to inadvertent errors, 
extenuating circumstances, by mutual agreement and/or to ensure better student learning on terms 
favorable to all students.

**Academic Honesty and Misconduct**
All students in CLAS courses are expected to abide by the CLAS Code of Academic Honesty. 
Undergraduate academic misconduct must be reported by instructors to CLAS according to these 
procedures, Graduate academic misconduct must be reported to the Graduate College according to 
Section F of the Graduate College Manual.

In addition to the Academic Honesty code offenses detailed by the College, there are course 
specific expectations regarding Academic Honesty:

**Examinations:** You are expected to work alone. Cheating will not be tolerated. The instructor 
believes strongly in fairness for all students and objective appraisal of individual performance and 
understanding of material.

**Problem Sets:** The homework for this course is designed to help you master your knowledge 
related to the topics covered during lecture. As such, you may work on the homework problems 
with others or use online resources; however, please be aware that to master the skills needed 
for this class, practice is required and that to do well on exams you will need to work many of 
these problems multiple times without help. Be sure to test your knowledge by doing much of the 
homework on your own. I **encourage you to ask your classmates for help, but be sure you** 
**ask them to explain their reasoning in a way that you can understand to ensure you acquire** 
an independent understanding of the course material.

**Student Complaints**
Students with a complaint about a grade or a related matter should first discuss the situation 
with the instructor and/or the course supervisor (if applicable), and finally with the Director or 
Chair of the school, department, or program offering the course.
Undergraduate students should contact CLAS Undergraduate Programs for support when the matter is not resolved at the previous level. Graduate students should contact the CLAS Associate Dean for Graduate Education and Outreach and Engagement when additional support is needed.

Drop Deadline for this Course
You may drop an individual course before the deadline; after this deadline you will need collegiate approval. You can look up the drop deadline for this course here. When you drop a course, a "W" will appear on your transcript. The mark of "W" is a neutral mark that does not affect your GPA. Directions for adding or dropping a course and other registration changes can be found on the Registrar's website. Undergraduate students can find policies on dropping and withdrawing here. Graduate students should adhere to the academic deadlines and policies set by the Graduate College.

Date and Time of the Final Exam
The final examination date and time will be announced by the Registrar generally by the fifth week of classes and it will be announced on the course ICON site once it is known. Do not plan your end of the semester travel plans until the final exam schedule is made public. It is your responsibility to know the date, time, and place of the final exam. According to Registrar's final exam policy, students have a maximum of two weeks after the announced final exam schedule to request a change if an exam conflict exists or if a student has more than two exams in one day (see the policy here).

College of Liberal Arts and Sciences (CLAS) Course Policies

Course Home: The College of Liberal Arts and Sciences (CLAS) is the home of this course, and CLAS governs the add and drop deadlines, the “second-grade only” option (SGO), academic misconduct policies, and other undergraduate policies and procedures. Other UI colleges may have different policies.

Attendance and Absences

University regulations require that students be allowed to make up examinations which have been missed due to illness or other unavoidable circumstances. Students with mandatory religious obligations or UI authorized activities must discuss their absences with me as soon as possible. Religious obligations must be communicated within the first three weeks of classes.

Exam Policies

Communication: UI Email
Students are responsible for all official correspondences sent to their UI email address (uiowa.edu) and must use this address for any communication with instructors or staff in the UI community.

University Policies

Accommodations for Students with Disabilities
Basic Needs and Support for Students
Classroom Expectations
Exam Make-up Owing to Absence
Free Speech and Expression
Mental Health
Military Service Obligations
Non-discrimination
Religious Holy Days
Sexual Harassment/Misconduct and Supportive Measures
Sharing of Class Recordings