

**Chemistry 302: Physical Chemistry II**  
Department of Chemistry & Biochemistry, Loyola University Chicago  
Spring 2014

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Instructor: Dr. Dan Killelea  
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Email: [dkillelea@luc.edu](mailto:dkillelea@luc.edu)  
Office Hours: M 12:30 – 1:30pm, **and by appointment** (FH 103)  
Lecture: TR 10:00 – 11:15 am, Cuneo 104  
Discussion: M 1:40 – 2:30 pm, Flanner 007 **or** T 8:30 – 9:45 am, Flanner 129  
Text: Physical Chemistry, Atkins & De Paula, W.H. Freeman, 9<sup>th</sup> Edition  
Facebook: Luc PChem

Course Prerequisites: Chemistry 301 and Math 263 (Multivariate Calculus). Math 264 (Ordinary Diff. Eq.) is strongly encouraged. If you have not completed the course prerequisites, you may be administratively dropped from the class. Please discuss this with the instructor immediately!

Please see the Facebook page or the Sakai site for up-to-date information and posts.

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### Course Overview

Welcome to Physical Chemistry II! We will move beyond the macroscopic world of thermodynamics and use quantum mechanics to understand atomic and molecular structure. We will start with the historical development and fundamentals of quantum mechanics as it applies to chemistry and then apply the lessons learned to hydrogenic atoms. We will then study atomic and molecular spectroscopy, and finally return to statistical thermodynamics to link the microscopic world to the macroscopic.

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### Course Structure

There are two 75-minute lectures (T, R) and one 50-minute discussion section (M **or** T) per week. As valuable as lectures may be, you will gain much more by **completing** assigned reading and problem sets **BEFORE** the lecture. By coming to lecture prepared, you will be able to fill in any remaining gaps, and can *ask questions* to better comprehend the material. I cannot overstate how much more useful the lectures will be if you come into the room well prepared, and even better, with questions for me and your fellow classmates. The three keys to success in physical chemistry are reading the text, solving as many problems as possible, and *asking questions!* Ask me questions about the material in class and office hours and ask your classmates questions. Furthermore, use the Facebook site to ask your classmates questions and me or for clarification.

As a courtesy to your classmates, please completely silence (not just vibrate mode) any audible devices you have with you before entering the classroom. The use of computers or whatnot during class is permitted, as long as it is silent, but is discouraged.

The discussion section will be small group work. You will work in small groups (3-6 people) on problems I provide that are similar to the assigned problems, with the goal of working with your classmates to learn the material.

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## Grading

Your grade will be determined on a basis of **600** points.

*Tests* (300 points): We will have four half-period tests. These will be shorter than an hour exam. We will have four tests worth 100 points each, and the low score is dropped. There *may* be 'extra credit' on the tests. During the test, you may not use *any* electronic device (e.g. cell phones or computers) aside from a non-programmable scientific calculator. Please check the calculator with me if in doubt. If any banned device is observed, this will be construed as cheating.

*Final Exam* (150 points): The final exam will be cumulative and will be worth 150 points.

*Quizzes* (90 points): In the weeks without a test, you *may* have a short quiz on the material covered in class. There will be six quizzes worth 15 points each.

*Participation and Evaluation* (60 points): Active participation in discussion is required; asking questions in lecture is strongly encouraged. Up to 50 points are possible for students who are regular and active participants. Finally, when you complete the course evaluation, provide a copy of the acknowledgement page for 10 points.

*Discovery Problems*: Problems from the text will be assigned to help you learn the material. These will not be collected, but it will be to your benefit to complete the problems.

*There will be no make-up quizzes, tests, or exams given under virtually any circumstance.*

**Final Exam:** The College of Arts & Sciences schedules the final exam. The final will be held on:

**Tuesday, April 29<sup>th</sup>, 2014 at 1:00 pm**

in Cuneo 104 (regular room). You will have exactly 2 hours to complete the exam. Additional time will not be granted, even if you arrive late. There will be no make-up final exams given under any circumstance, and the exam will not be given early, either.

**Grading:** There is a maximum of 600 points, letter grades will be assigned as given below:

|            |           |            |
|------------|-----------|------------|
|            | A: > 93%  | A-: 93–90% |
| B+: 90–87% | B: 87–82% | B-: 82–80% |
| C+: 80–78% | C: 78–72% | C-: 72–70% |
| D: 70–55%  | F: < 55%  |            |

## Supplementary Material

Companion site for Atkins Physical Chemistry: <http://bcs.whfreeman.com/pchem9e>

Physical Chemistry, 6<sup>th</sup> Ed., by Ira Levine

MIT Open Course Ware, Physical Chemistry (5.61) (<http://ocw.mit.edu/courses/chemistry/5-61-physical-chemistry-fall-2007/lecture-notes/>). Excellent note source with exam questions.

Physical Chemistry, Harcourt Brace Jovanovich College Outline Series, by J. Edmund White.

Unfortunately, this seems like it is out of print, but is available used. Very useful distillation of the course material for both semesters of Physical Chemistry with numerous problems.

Quanta, Matter, and Change, Atkins & DePaula

Physical Chemistry: A Molecular Approach, McQuarrie and Simon

## Schedule

Note: The instructor reserves the right to make changes to the schedule, the outline below will give you an idea of the material we will cover. Any changes will be announced in class, or on Facebook, or Sakai. Reading assignments are from Atkins & De Paula unless noted otherwise.

| <i>Week</i>                                     | <i>Date</i> | <i>#</i> | <i>Lecture Topics</i>                   | <i>Reading</i> | <i>Other</i> |
|---|-------------|----------|---|----------------|--------------|
| 1   | 14 Jan      | 1        | Intro to Quantum                        | Ch. 7          |              |
|   | 16 Jan      | 2        |   |                |              |
| 2   | 21 Jan      | 3        |   |                | No M Disc    |
|   | 23 Jan      | 4        | Quantum Theory                          | Ch. 8          |              |
| 3   | 28 Jan      | 5        |   |                |              |
|   | 30 Jan      | 6        |   |                |              |
| 4   | 4 Feb       | 7        | (Test 1) Atomic Structure and Spectra   | Ch 9           |              |
|   | 6 Feb       | 8        |   |                |              |
| 5   | 11Feb       | 9        | Molecular Structure                     | Ch 10          |              |
|   | 13 Feb      | 10       |   |                |              |
| 6   | 18 Feb      | 11       |   |                |              |
|   | 20 Feb      | 12       |   |                |              |
| 7   | 25 Feb      | 13       | (Test 2) Symmetry                       | Ch 11          |              |
|   | 27 Feb      | 14       |   |                |              |
| 8   | 4 Mar       |          | SPRING BREAK: No Classes                |                |              |
|   | 6 Mar       |          |   |                |              |
| 9   | 11 Mar      | 15       | Vibrational and Rotational Spectroscopy | Ch. 12         |              |
|   | 13 Mar      | 16       |   |                |              |
| 10  | 18 Mar      | 17       |   |                |              |
|   | 20 Mar      | 18       |   |                |              |
| 11  | 25 Mar      | 19       | (Test 3) Electronic Spectroscopy        | Ch. 13         |              |
|   | 27 Mar      | 20       |   |                |              |
| 12  | 1 Apr       | 21       | Magnetic Resonance                      | Ch. 14         |              |
|   | 3 Apr       | 22       |   |                |              |
| 13  | 8 Apr       | 23       |   |                |              |
|   | 10 Apr      | 24       |   |                |              |
| 14  | 15 Apr      | 25       | (Test 4) Statistical Mechanics          | Ch. 15+16      |              |
|   | 17 Apr      |          | No Class: Easter Break                  |                |              |
| 15  | 22 Apr      | 26       |   |                | No M disc    |
|   | 24 Apr      | 27       |   |                |              |
| Tuesday, 29 April: FINAL EXAM, 1:00pm to 3:00pm |             |          |   |                |              |

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## Academic Integrity

All students in this course are expected to have read and to abide by the demanding standard of personal honesty, drafted by the College of Arts & Sciences, that can be viewed at:  
[http://www.luc.edu/cas/pdfs/CAS\\_Academic\\_Integrity\\_Statement\\_December\\_07.pdf](http://www.luc.edu/cas/pdfs/CAS_Academic_Integrity_Statement_December_07.pdf)

Anything you submit that is incorporated as part of your grade in this course (e.g. quiz, examination, homework, lab report) must represent your own work. Any students caught cheating will, at the very minimum, receive a grade of "zero" for the item that was submitted and this grade cannot be dropped. If the cheating occurred during a course exam, the incident will be reported to the Chemistry Department Chair and the Office of the CAS Dean. Depending on the seriousness of the incident, additional sanctions may be imposed.

I have no tolerance whatsoever for cheating or plagiarism. *Any instance of dishonesty (including those detailed on the website provided above or in this syllabus) during a quiz, test, or exam will result in a failing grade for the course.* The Dean of Arts & Sciences and The Chair of The Department of Chemistry will also be notified. I truly hope to never have to invoke these processes. Please be honest with your work.

**Teamwork:** I strongly encourage you (the class) to work together to solve assigned and unassigned problems. In order to learn and excel in Physical Chemistry, you should work through problems. The assigned problems are a minimum. Work together with your classmates, if you do not understand something, someone else may. You will also find that explaining a solution to your classmate will cement the information in your mind, and make you a better student.

When working as a group, if each member contributes to the discussion, and you each hand in very similar work, that is perfectly acceptable given the nature of the assignments. On the other hand, if someone simply copies an assignment from someone else, that is plagiarism, and will be treated as such.

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## Students with Disabilities

If you have any special needs, please let me know in the first week of classes. The university provides services for students with disabilities. Any student who would like to use any of these university services should contact the Services for Students with Disabilities (SSWD), Sullivan Center, (773) 508-3700. Further information is available at <http://www.luc.edu/sswd/>.

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## Tutoring

The Loyola Undergraduate ACS has open tutoring every week on W and R evenings in Flanner 129. In addition, Loyola maintains a Center for Academic Excellence & Tutoring (<http://www.luc.edu/tutoring/>). Again, this is a service included in your tuition, so I encourage you to utilize their assistance.

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## Your well-being

If there are events occurring in your life that cause school to diminish in its priority, please discuss this with me or contact the Wellness Center (<http://www.luc.edu/wellness/index.shtml>) or the dean of students ([http://www.luc.edu/studentlife/dean\\_of\\_students\\_office.shtml](http://www.luc.edu/studentlife/dean_of_students_office.shtml)) for assistance. These are services that **your** tuition pays for and can be invaluable for your personal health and maintaining progress towards your degree.