



CHM3400:

Essential Physical Chemistry

(in One Semester)

Fall 2020 3 credit hours

Class Number(section): 11362(5086)

M Period 7 (13:55-14:45); W Periods 7-8 (13:55 - 15:50)

Synchronous online meeting via *Zoom* or equivalent

No (specifically) Required Textbook:

However, you will need access to *at least* one of the resources below.

Officially recommended: “Physical Chemistry for the Biosciences”, Raymond Chang. Available as an eBook through [RedShelf](#)

A very good alternative: “Physical Chemistry: Principles and Applications in Biological Sciences”, Ignacio Tinoco, Jr., *et al.*

An acceptable alternative (*free* to access through the UF libraries): “Physical Chemistry for the Biological Sciences”, G.G. Hammes, *et al.* [eBookCentral](#)

A strongly suggested additional reference Any mainstream two-semester PChem text. Some resources of this ilk are available on the course website.

Contact Brucat if you have questions...

Instructor: PJ Brucat

- Office location: Zoom. See website for link
- Scheduled (group) office hours (subject to change):
 - Tuesday’s Periods 3-4 (09:35 - 11:30)
 - Thursday’s Periods 5-7 (11:45 - 14:45)
- Additional office hours:
 - by Appointment, offer three choices (see below)
- Contact method: *Canvas Messaging only*

TA: Jinze “Richard” Xue

Course Website:

<https://ufl.instructure.com/courses/404338>

All course materials and course communications will be delivered from within UF’s eLearning system (Canvas) at the URL above. Please become familiar with our course website as soon as possible. Note that the materials there will be subject to change, so pay attention to all announcements and posts in that site. Check the site daily and set your account to receive email notifications of new or changed material. **It is strongly suggested that printing or static downloads of notes or schedule information be avoided.**

| | | FALL SEMESTER 2020 | | | | | | |
|-------|----|--------------------|----|----|----|----|----|---|
| | | S | M | T | W | T | F | S |
| Aug. | 23 | 24 | 25 | 26 | 27 | 28 | 29 | |
| | 30 | 31 | | | | | | |
| | | Drop/Add | | | | | | |
| Sept. | | | 1 | 2 | 3 | 4 | 5 | |
| | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| | 13 | 14 | 15 | 16 | 17 | 18 | 19 | |
| | 20 | 21 | 22 | 23 | 24 | 25 | 26 | |
| | 27 | 28 | 29 | 30 | | | | |
| Oct. | | | | | | 1 | 2 | 3 |
| | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| | 11 | 12 | 13 | 14 | 15 | 16 | 17 | |
| | 18 | 19 | 20 | 21 | 22 | 23 | 24 | |
| | 25 | 26 | 27 | 28 | 29 | 30 | 31 | |
| Nov. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| | 8 | 9 | 10 | 11 | 12 | 13 | 14 | |
| | 15 | 16 | 17 | 18 | 19 | 20 | 21 | |
| | 22 | 23 | 24 | 25 | 26 | 27 | 28 | |
| | 29 | 30 | | | | | | |
| Dec. | | | 1 | 2 | 3 | 4 | 5 | |
| | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| | 13 | 14 | 15 | 16 | 17 | 18 | 19 | |
| | 20 | 21 | 22 | 23 | 24 | 25 | 26 | |
| | 27 | 28 | 29 | 30 | 31 | | | |

Course Goals

CHM3400 is designed to provide essential skills and a working mastery of the concepts embodied in the five pillars of physical chemistry to undergraduate students in the biochemistry track that otherwise receive no other formal training in the discipline. The five pillars are:

- Thermodynamics
- Kinetics and Transport
- Quantum Mechanics
- Statistical Mechanics
- Spectroscopy

This is an arduous challenge, and will necessarily involve some reduction in rigor when compared to the full 8-credit curriculum in Physical Chemistry typical of traditional Chemistry majors. Nonetheless, the essential flavor of the material will be retained and a base of understanding for future study will be established.

Course Objectives

Mastery of the course goals will involve much more than just memorizing facts or applying equations. Physical Chemistry is a discipline, and as such is a methodology, a mindset, and a style of approaching the understanding of the Universe. The following milestones will be intermediate objectives in achieving subject mastery:

- Connect the roles and features of empirical observation, statistical correlation, data fitting, modeling, and simulation.
- Develop an ability to visualize hypotheses as numerical predictions, and use this skill to refine and correct assumptions.
- Understand the Laws of Thermodynamics and apply them to chemical problems.
- Describe the time dependence of reaction and transport processes mathematically and use this understanding to determine reaction mechanisms.
- Embrace the behavior of the microscopic world and in particular the motion of the electron in terms of the tenants and postulates of Quantum Mechanics.
- Use concepts of statistics and probability to connect the microscopic nature of matter to macroscopic properties.
- Understand how the interaction of light with matter can be used to 'see' Chemistry.

Course Meetings There are four meeting types intrinsic to the learning experience of this course.

1. **Lectures** This course has regularly-scheduled meeting times designated for synchronous meetings of the entire class. These meetings are a on-on-many environment primarily for presentation and explanation of new material outlined in the course notes (which are available before lecture on the course website and should be thoroughly processed by the learner before the corresponding lecture occurs). Attendance and participation in all lectures is required. Questions and clarification requests during all lectures are encouraged. Each lecture will be recorded by the Instructor and available on the course website under the Zoom Conferences link. Each lecture will be followed by a Community Review activity, see below.
2. **Office Hours** Your Instructor (and TA) will have regularly-scheduled office hours. The purpose of these meetings is primarily to assist students in their learning in a one-on-few environment. Answering questions and assisting in the successful completion of assignments is an essential goal of these office hours, but so is tailoring learning and removing conceptual stumbling blocks as prudent. Attendance is optional. Students may record these meetings if all participants are amenable.
3. **Individual Conferences** Your Instructor will organize regular one-on-one meetings with all students in the class. These meetings will be arranged in blocks on the Canvas Calendar tool, and students will choose their own meeting time from within the available choices. One such conference block will occur in the first week of classes, and at least two more will occur throughout the term. The purpose of these meetings is to allow a direct communication between the Instructor and the learner, and facilitate the Instructors understanding of the status of each individual in the class. Discussion of grades, personal circumstances, and sensitive advice are possible in one-on-one meetings and not appropriate for public ones. Attendance in these meetings is required.
4. **Ad Hoc Conferences** Any student may request an *ad hoc* one-on-one meeting with the instructor, or even schedule an extra office hour, at any time. Such requests will be made through Canvas Messaging (do not use email). Requests must include three distinct times for the requested meeting and whether the meeting is to be private or not. The Instructor will respond within 8 hours (usually much less) by accepting one of the times and provide a video conferencing link. Such conferences are not restricted to normal business hours, but are constrained by conflicts and mundane life activities.

All the above meetings will be administered through the video conferencing application, Zoom. If, for some reason this methodology fails, another UF-approved conferencing application will be utilized, such as Google Meet, or Microsoft Teams. It is presumed that all of these applications are familiar to UF students in these dark times. If not avail yourself the documentation available for their use on UF's [eLearning website](#).

Attendance Your attendance at all our scheduled lectures and individual meetings is *required*. If you are unable to make any given synchronous meeting for some reason, please message the Instructor (within Canvas) *before* the meeting (if possible) or as soon after as the circumstances permit (in the case of a medical emergency). Excused absences are defined by [University attendance policy](#). Unexcused absences will result in grade penalties at the discretion of the Instructor.

Etiquette Your polite, courteous, and civilized behavior is expected in all aspects of our course. This holds especially true in these times of stress and uncertainty. Be Human.

Course Activities In addition to meetings, there are a number of other activities included in the course operation.

Lecture Preparation *Before* each Lecture, a preparation assignment will be posted. At the very least it will include reading in the Course Notes, which should always be augmented by additional reading in the textbook(s) you have at your disposal. Lecture preparation Assignments are not graded.

Lecture Schedule (tentative; see Canvas website course stream)

| Week | Date | Lec | Topic | Notes Section |
|------|-------|-----|---|---------------|
| 1 | 08/31 | 01 | Syllabus, Operation, and Introduction to Thermodynamics | 0-1.2 |
| | 09/02 | 02 | Thermodynamic Law, Energy, and Temperature | 1.3-1.5 |
| 2 | 09/07 | – | Labor Day | – |
| | 09/09 | 03 | Enthalpy, Adiabaticity, and Heat-Work Conversion | 1.5-1.8 |
| 3 | 09/14 | 04 | Elastomers; Free Energy of Mixing | 1.9-1.10 |
| | 09/16 | 05 | Equilibrium: Reactive and Phase; Interfaces | 1.11-1.13 |
| 4 | 09/21 | 06 | Multicomponent Phase Equilibria; Colligative Properties | 1.14-1.15 |
| | 09/23 | 07 | Electrolytes and Electrochemistry | 1.16-1.17 |
| 5 | 09/28 | 08 | Elementary Kinetics | 2.1-2.2 |
| | 09/30 | 09 | Complex Reactions; Enzyme Kinetics | 2.2-2.3 |
| 6 | 10/05 | 10 | Transport Processes; Fick's Laws | 2.4 |
| | 10/07 | 11 | Conductivity and Diffusion | 2.5-2.6 |
| 7 | 10/12 | 12 | An Introduction to Mechanics | 3.1 |
| | 10/14 | 13 | The Flavor of Quantum Mechanics; Measurement | 3.2-3.3 |
| 8 | 10/19 | 14 | Bound and Unbound Motion | 3.4 |
| | 10/21 | 15 | Time Dependence and Superposition; Examples | 3.5-3.7 |
| 9 | 10/26 | 16 | Approximate Methods in Quantum Mechanics | 3.8 |
| | 10/28 | 17 | Atoms and Molecules | 3.9-3.11 |
| 10 | 11/02 | 18 | Probability and Thermal Equilibrium | 4.1 |
| | 11/04 | 19 | The Boltzmann Distribution; The Partition Function | 4.2-4.3 |
| 11 | 11/09 | 20 | Cooperative Binding; Allosterism | 4.4 |
| | 11/11 | – | Veteran's Day | – |
| 12 | 11/16 | 21 | Thermodynamic Properties; Molecular Dynamics Simulation | 4.5-4.6 |
| | 11/18 | 22 | Light and Matter; Absorption and Emission | 5.1-5.3 |
| 13 | 11/23 | 23 | The Born-Oppenheimer Approximation; Term Energies | 5.4-5.5 |
| | 11/25 | – | Thanksgiving | – |
| 14 | 11/30 | 24 | Technical Aspects: Action; Resolution; Sensitivity | 5.6 |
| | 12/02 | 25 | Intro to Magnetic Resonance; Coherence | 5.7-5.8 |
| 15 | 12/07 | 26 | Nuclear Magnetic Resonance: Inversion and Echos | 5.9 |
| | 12/09 | 27 | Summary, Review, and Retrospective | <i>all</i> |

Lecture Review *After* each lecture, there will be a Community Review assignment delivered in [VoiceThread](#). The assignment is a guided discussion of the topics in that Lecture. You will be asked to post comments (of any media type) on the Course Notes of the day, which will form a running dialog involving the entire learning community. This activity will be graded according to the criteria for comments, detailed in the assignment header.

Course Work (CW) Periodically problems will be assigned through Canvas relevant to the mastery of the topics at hand. These problems sets may be challenging to a new learner of Physical Chemistry, so collaboration on their completion is encouraged. However, the submission of each student must be their own original work. These problem sets will be graded with comments returned to the student.

| Assignment | Date (approx) |
|------------|---------------|
| CW01 | 09/11 |
| CW02 | 09/25 |
| CW03 | 10/09 |
| CW04 | 10/23 |
| CW05 | 11/06 |
| CW06 | 11/20 |
| CW07 | 12/04 |

Concept Quizzes (CQ) Weekly, short question sets will be delivered online through our course website. These assessments are to be worked alone, with no assistance from anyone or anything not included in the quiz instructions. You are on your Honor to comply with these instructions. Thorough Lecture Preparation and Review should make these enjoyable and quick.

| Assignment | Date (approx) |
|------------|---------------|
| CQ01 | 09/04 |
| CQ02 | 09/10 |
| CQ03 | 09/18 |
| CQ04 | 09/24 |
| CQ05 | 10/01 |
| CQ06 | 10/08 |
| CQ07 | 10/16 |
| CQ08 | 10/22 |
| CQ09 | 10/30 |
| CQ10 | 11/05 |
| CQ11 | 11/13 |
| CQ12 | 11/19 |
| CQ13 | 12/03 |
| CQ14 | 12/09 |

Final Exam There will be an optional cumulative Final Examination to be given at course termination. The exam is optional at the discretion of the class *unless* there is a case of unreported Honor Code violation in this course, in which case the final becomes mandatory for all. The purpose of an optional final is to allow students that do not feel that their grades during the term do not accurately reflect their knowledge and expertise in the subject matter. If the final exam is taken, its grade is averaged with the CQ grade in the final grade computation. See below for details of the course grade computation.

**All activity dates and grades are posted on the [course website in Canvas](#).
Assignments are to be submitted in full by the assignment deadline for credit.**

Course Grade Computation: Course grades will be computed from the weighted-average of the earned percentages of each graded item submitted by the student. The weighting factors are as follows:

Category Weights

| Grade Category | weight % without Final | weight % with Final |
|-------------------|------------------------|---------------------|
| Lecture Prep | 0 | 0 |
| Community Review | 30 | 30 |
| Concept Quiz (CQ) | 50 | 25 |
| Course Work (CW) | 20 | 20 |
| Final Exam | 0 | 25 |

Grade Percentages

| Grade | A | A- | B+ | B | B- | C+ | C | D | E |
|--------------------|------|------|------|------|------|------|------|------|--------|
| Minimum percentage | 87.5 | 80.0 | 77.5 | 72.5 | 70.0 | 67.5 | 60.0 | 50.0 | < 50.0 |

Regrade Requests Assignments will be regraded if an error is suspected. Regrade requests must be submitted through Canvas Messaging within 72 hours of the grade post. Regrades will be performed on the entire assignment.

UF's Grading Policy: See <http://www.registrar.ufl.edu/grades/gradepolicy.html> and <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Honesty and Truthfulness: Ethical, moral, and professional behavior is expected and required of all participants in this course. Moreover, all participants in UF's Academic activities are bound by [Rules of Conduct](#), from which can be found:

“UF students are bound by The Honor Pledge which states,

‘We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code.’

On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied:

‘On my honor, I have neither given nor received unauthorized aid in doing this assignment’

The Honor Code (<http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class”

The interpretation of honorable behavior here at UF can be summarized in three simple guidelines.

1. Be an example of honesty, integrity and moral character. *Be a Good Gator*
2. Discourage others from falling victim to the temptations of dishonesty. Lead by example. *Be a part of the Gator Nation*
3. Don't let others cheapen the value of your education, your experience, and your degree. Don't let cheaters win. *Keep the Gator Nation Great*

Accommodations: Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, www.dso.ufl.edu/drc/) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Counseling: Useful non-academic services are available in many forms at UF. A good source of information is the Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc/>

GatorEvals: “Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.”

Virtual Classroom Recording: “Our class sessions may be audio-visually recorded for students in the class to refer back and for enrolled students who are unable to attend live. Students who participate with their camera engaged or utilize a profile image are agreeing to have their video or image recorded. If you are unwilling to consent to have your profile or video image recorded, be sure to keep your camera off and do not use a profile image. Likewise, students who un-mute during class and participate verbally are agreeing to have their voices recorded.

If you are not willing to consent to have your voice recorded during class, you will need to keep your mute button activated and communicate exclusively using the “chat” feature, which allows students to type questions and comments live. The chat will not be recorded or shared.

As in all courses, unauthorized recording and unauthorized sharing of recorded materials is prohibited.”

All course policies, activities, operations, and procedures are subject to change at any time at the sole discretion of Brucat

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