



# CHM 4412: Physical Chemistry, Quantum Mechanics and Spectroscopy

Summer C 2013 (May 13 - August 09) Section 7397  
(4 Credit Hours)  
M WRF Period 2 09:30 - 10:35 TUR 2341

**No (specifically) Required Textbook:** Useful texts include *the one you have* or something like: "Physical Chemistry", P. W. Atkins, or similar titles by Levine, Raff, Castellan, etc.  
{See BruCAT if you have questions...}

**Instructor:** PJ BruCAT  
Office Location: CLB311E  
Office Hours: by appointment  
Office Hours Location: CLB313 (PChem Conf Rm)  
Contact info  
Email: [Use iTeach Messaging](#)  
Phone: 392-4654 (use iTeach messaging first)

**Teaching Assistant:** Shuai Wang and Jonathan van der Henst Solis  
TA Office Location: TBA  
TA's Office Hours: TBA

**Course Website:** <http://iteach2.chem.ufl.edu/24/>

SUMMER SEMESTER 2013							
S	M	T	W	T	F	S	
May	5	6	7	8	9	10	11
	--Drop/Add--					Registration	
	12	13	14	15	16	17	18
	19	20	21	22	23	24	25
	26	Holiday	27	28	29	30	31
June							1
	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	Grad. Due	24	25	Summer Break	26	27
						Registration	28
							29
							30
July		--Drop/Add--			Holiday		
	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			
Aug.					1	2	3
	4	5	6	7	8	9	10
	11	12	13	14	15	16	17
		Grad. Due	12	Deg. Cert	13	14	15
							16
							17

Tentative Syllabus (for exact ordering and schedule of lectures, see the course website)

## An Introduction to Quantum Mechanics

Compare and Contrast Classical and Quantum Descriptions of Matter  
Fundamental Principles (Postulates) of Quantum Mechanics  
Operators, Observables, Wavefunctions, Eigenvalues, and Boundary Conditions

## Exactly Soluble Systems in One Dimension

Free Particle Particle in a Box The Harmonic Oscillator  
Traditional (Diff. eq.) Treatment  
Operator Algebra Treatment

## Systems in More than One Dimension

3D Particle in a Box 3D SHO  
Rigid Rotation and the Spherical Harmonics  
The Hydrogen Atom  
Many-Electron Atoms

## Approximate Methods in Quantum Mechanics

Perturbation Theory Variational Principle

## Independent Particle Approaches to Electrons in Molecules

Molecular Orbitals (Qualitative Aspects) Molecular Symmetry and its Consequences

## Understanding Molecular Motion *Spectroscopically*

The Separation of Molecular Motion by Time/Energy Scale  
The Measurement, Excitation and Control of Molecular Motion with Light  
A Survey of Spectroscopic Techniques  
Magnetic Resonance, Coherence, and Pure vs. Mixed States

## This course is different from most other courses

That is not as bold a statement as it may seem. First, the subject matter (Quantum Mechanics and its applications) is so odd that we will ask and answer questions about the world around us in ways that you might never have imagined. So, the course is different because the subject is different.

Any enthusiastic student of Quantum Mechanics knows that learning this subject requires a different mind-set when compared to other topics of similar complexity. Thus, the organization of this class is also different to help foster this mind-set. 'Lectures', which will now be called 'readings', will be absorbed outside of class (at 'home'), and traditional 'homework' activities will be performed during our class meetings. The eduspeak [sic] people call this a 'flipped' class, and it is quite *en vogue* these days.

Naturally, the 'readings' are not going to be complete enough to satisfy every given individual on every topic/concept in covered in this course. Therefore, it is up to the student to seek additional information from your textbook, the library, etc. as you need it. See one of your instructors for assistance if you have difficulty finding material on a particular topic.

## Oh, and you're going to need a computer

The course website: < <http://iteach2.chem.ufl.edu/24> > is where the 'lecture' ⇒ 'reading' materials are found. Naturally, all course operation details and communication tools are there, too. The format of these materials is somewhat varied, and some work better than others. Some delivery formats may have bugs and not work on all devices equally well. For example, some smartphones or tablets might not work correctly when viewing the modules. You are going to have to be a little more flexible, understanding, and tech savvy with in this environment than in a typical lecture-based class, but it will be worth it. *Next time I teach this course I will tell your successors stories of your valor and bravery.* The Science Library computers have all the tech requirements for this course, in case you don't, and there are knowledgeable and helpful people around them as well

## Attendance

This term, we are going to learn Quantum Mechanics and Spectroscopy as a team. Therefore, your timely presence in our class meetings is kindly requested. You are an integral part of the classwork sessions, so class meetings are very important. If you choose not to attend, that is your choice, but this action lets down your classmates, and forfeits your rights to classwork points (see below) and Instructor office hours, scheduled or by appointment. If you cannot attend class due to a medical/justifiable reason, contact your Instructor in advance using the website messaging tool.

## Office Hours

Office hours held by Brucat are intended for one-on-one discussion of a students standing in the class (grades), learning strategy and habits, and any other things not appropriate for the group discussion. They will be held at times you arrange. If you want a meeting of this sort, message your instructor 3 options for meeting times that are convenient for you, and your instructor will message make the choice that works.

Office hours held by TA's are to provide perspective different from Brucat and his 'Readings' on the subject material. TA office hours will be posted on the course website calendar or by appointment.

--- Graded Activities ---

## On-line Quizzes and 'Readings'

Periodically throughout the term, short on-line assessments will be delivered through the course website. These 'Quizzes' will appear in the website topics list and on the course calendar. Instructions for each quiz will be explicitly stated for each one at its start; Please read these instructions carefully.

Brucat's 'Readings' are also delivered on-line, and have a few embedded assessment questions which are graded.

As the course is presently crafted, there are 10 on-line 'Quizzes' and 30 'Readings' which have total 160 grade points.

## 'Homework' is now 'Classwork'

We do what would normally be called 'Homework' in class; 'flipped' remember? Problems relevant to the material and concepts covered in our 'readings' will be worked in class, by you, the TA and the Instructor together as a team. No more frustrating nights not knowing where to start. 'Classwork' will be valued at 20 grade points per week for a total of 240 grade points

## Exams

There will be **four** in-class exams during the term, which determine the bulk of your course grade, *tentatively* to be held on the following Thursdays:

**May 31      June 21      July 19      August 07**

I write the Songs... but you write the Exams. That's right! For each of the 4 parts of the course, there will be a Wiki for you the class to construct the actual exam you will take. Not as easy as you think, really. Exam grades will be based partially on your individual work on Exam day and partially on the grade your instructor gives the Wiki. So, do a good job writing the Exam.

## Course Grade Computation

Course grades will be computed from the sum of earned points by the student. Each exam has a maximum value of 150 grade points for a category total of 600 points. Your 'Readings' + 'Quiz' (160 points) and 'Classwork' (240) bring the grade point total for the term to 1000. Your letter grade will be computed from this 1000 grade point total using this scheme:

Course Grade	<i>Minimum</i> Total Score
A	875
A-	800
B+	775
B	750
B-	725
C+	675
C	650
C-	625
D	500
E	< 500

Students, faculty, and all participants in UF's Academic activities are bound by an [Honor Code](#). [Students with Disabilities](#) may request special accommodations through the Dean of Students. [Counseling](#) services are available through several UF organizations.

UF's Grading Policy: <http://www.registrar.ufl.edu/catalog/policies/regulationgrades.html>

*We, the members of the University of Florida Community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity*