

**Syllabus**  
**Fundamentals of Physical Chemistry (CHM 3400)**  
**Fall 2015**

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**Instructor:** David Chatfield, CP 336, 305-348-3977, [David.Chatfield@fiu.edu](mailto:David.Chatfield@fiu.edu), [casfaculty.fiu.edu/David.Chatfield/](http://casfaculty.fiu.edu/David.Chatfield/)

**Office Hours:** T 2:00-4:00 or by appointment

**Class Time and Place:** TR 11:00 AM-12:15 PM, CP 117.

**Final Exam Time and Place:** Thurs Dec 10, 9:45-11:45 AM, CP 117.

**Mid-term Exams:** Tentatively planned for Tues Sep 22 and Tues Oct 27. The date will be made firm at least one week in advance. Make-ups will only be allowed in extraordinary circumstances, and only with prior consultation with the instructor.

**Text:** Raymond Chang *Physical Chemistry for the Biosciences, 2nd Ed.*, University Science Books, 2005, ISBN 1-891389-33-5 (paper).

**Prerequisites:** MAC 2311, 2312 (calculus); PHY 2048 or 2053, 2048L, 2049 or 2054, 2049L (physics); CHM 3120, 3120L (analytical chemistry).

**Course Description:** The course will survey the topics in physical chemistry of greatest use to chemists and biologists. These include thermodynamics, kinetics, and the quantum theory of atoms and molecules. If there is time, we will add the theory of spectroscopy.

**Grading:** Grading will be based on problem sets (10% of the grade), two mid-term exams (25% each), and a final exam (40%).

**Homework:** Homework will be assigned approximately each week and will be due on the Thursday of the following week. Homework will not be graded but will be assigned a check (legible, complete and mainly correct, 1.0 pts), or check minus (significantly deficient, 0.5 pts). Homework assignments and solutions will be posted on my website (see above). Late homework will not be accepted. **Be sure to keep up with the homework. Only by doing it will you solidify your learning.**

**Outline of course:** The chapters in the text will be followed in sequence, possibly with a few omissions. The chapters are short, so we will move through them rapidly (usually not more than one week per chapter). The outline below is ambitious. It is possible that some of the later material will be omitted. The chapters and topics to be covered are:

<u>Chapter</u>	<u>Topic</u>	<u>Chapter</u>	<u>Topic</u>
1	Introduction (on your own)	8	Acids and Bases
2	Properties of gases	9	Chemical kinetics
3	1st Law of Thermodynamics	10	Enzyme kinetics
4	2nd Law Thermodynamics	11	Quantum mechanics & atomic structure
5	Solutions		
6	Chemical equilibrium	12	The Chemical Bond
7	Electrochemistry	13	Intermolecular Forces

## Learning Goals:

Conceptualization Goals – develop these abilities:

- To create a conceptual framework for thinking about chemical processes.
- To use technical language appropriately to describe chemical processes.

Problem-solving Goals – develop these abilities:

- To map out an approach to a problem in physical chemistry.
- To apply equations appropriately to a solve problem in physical chemistry.
- To self-evaluate and determine whether your approach is appropriate and your solutions are correct.

Teamwork Building Goals

- Learn to work with others to build understanding and expertise

## Big Concepts

- *Thermodynamics* provides a system for quantifying and predicting the conditions (pressure, temperature, pH ...) under which chemical change will occur and how far a chemical reaction will proceed from reactants toward products. Thermodynamics is an elegant mathematical and conceptual system that provides basic tools all professional chemists use on a daily basis.
- *Chemical kinetics* provides a system for quantifying and predicting the rate at which chemical change will occur. Understanding and manipulating the rate of change is crucial for efficient biological and industrial processes.
- *Quantum mechanics* provides a foundation for understanding chemical systems at the microscopic (subatomic to molecular) level. The ideas of quantum mechanics underlie all nearly all the basic concepts in chemistry, including chemical bonding, the periodicity of the periodic table, and the spectroscopic analysis of materials.
- To master these areas, one must learn to think – to create mental models – of chemical systems at both the *microscopic* and the *macroscopic* levels, and to relate the two. Our intuitive understanding of the world is at the macroscopic level (we cannot see atoms or molecules). Chemistry and physics are founded on the notion that the microscopic nature of the world is essential to the way it works. Consequently it is crucial for students of chemistry to learn relate microscopic and macroscopic descriptions of chemical systems to each other.

**Academic misconduct:** *Cheating is unfair to your honest classmates and will not be tolerated.* Infractions will be dealt with according to University policy. Cheating includes (but is not limited to) any form of inter-student collaboration on exams or quizzes, use of prohibited materials or devices during exams (*viz. a cell phone*), copying or distribution of quiz or exam answers prior to the test, and plagiarism.

[http://online.fiu.edu/exams\\_academic\\_misconduct.html](http://online.fiu.edu/exams_academic_misconduct.html)

**Incompletes:** As per University policy, a grade of incomplete will only be given “...for work not completed because of serious interruption not caused by the student’s own negligence.” An incomplete will only be given if the majority of the work in the course has been completed, and after consultation with the instructor and preparation and signing of a written agreement outlining the reason for the incomplete and a timetable for making up the missing work.