

# CHM6430, CHEMICAL THERMODYNAMICS, FALL 2018

**INSTRUCTOR:** Prof. Russ Bowers, [bowers@chem.ufl.edu](mailto:bowers@chem.ufl.edu)

**OFFICE:** Physics Building, Rm. 2360

**OFFICE HOURS:** Thursday, 1:30-3:30pm or by appointment. I am generally available to answer questions via email.

**COURSE DESCRIPTION:** Covers the basic concepts of chemical thermodynamics and kinetics that are essential in all disciplines of chemistry and biochemistry. The course can also be beneficial to students as a refresher. The course will be tailored for non-physical chemists to strengthen their mathematical skills. The use of Wolfram's Mathematica will be integrated into the lectures and homework assignments and this course provides an excellent opportunity to become proficient in this software.

**MEETING PLACES AND TIMES:** MWF 4th period (10:40-11:30 AM), Flint 0109

## REQUIRED TEXT:

Molecular Thermodynamics, D.A. McQuarrie and J.D. Simon, University Science Books, Sausalito, CA; ISBN 1-891389-05-X.

**REQUIRED SOFTWARE:** Wolfram's Mathematica (available on UFApps or student edition)

## GRADING

	weight
Midterm Exams (3)	45%
Homework	25%
End of Term Project	30%

Approximate Grade Ranges			
>85	A	>60	C+
>80	A-	>55	C
>75	B+	>50	C-
>70	B	>45	D+
>65	B-	>40	D

**HOMEWORK:** Homework will be assigned and collected at the beginning of class each Monday. Selected problems will be graded based on clarity, organization, verbal exposition and accuracy of the answers. Late work will not be accepted under any circumstances. Papers that are not stapled will not be accepted.

**TERM PROJECT:** The term project will be selected by the student with approval of the instructor. The project should illustrate one or more fundamental concepts that have been covered in the course. The paper will be graded based on the written part (15%) and the oral presentation (15%).

**ATTENDANCE:** Attendance of lectures is essential for success in this class, and 100% attendance is expected. If you have a documented issue that requires you to miss, please inform the instructor as soon as possible.

**MAKE-UP EXAMS:** There will be no makeup exams unless prior arrangements are made. If an exam is missed for an excused reason, the final exam score will be used in the exam calculation. Homework assignments that are turned in late will not be accepted unless prior arrangements have been made.

**UF GENERAL INFORMATION ABOUT GRADES:** <https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

**PHILOSOPHY:** Thermodynamics is concerned with the quantitative description of macroscopic systems at equilibrium. It takes time to grasp some of the concepts of physical chemistry and to work through the problems. 'Cramming' is not the

way to be successful in this course. Homework assignments should be started as early as possible and completed over multiple sittings. The midterm exams are intended to assess mastery of key concepts, including elementary calculations and derivations. Preparation for exams should not be left to the night before the exam. Working on homework assignments in groups is strongly encouraged but copying another student's work will not be tolerated. Interaction or exchange of information in any format during the exams is strictly forbidden.

**CELL PHONES:** Please put all cell phones and other digital devices on "silent mode" during all class periods. During exams, your cell phone must be placed on the table in front of you, face down, for the entire test period.

**Honor Code:** This class will operate under the policies of the student honor code, which can be found at <http://www.registrar.ufl.edu/catalog/policies/students.html>. The students, instructor, and TAs are honor-bound to comply with the Honor Pledge: We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity.

**COUNSELING:** The University of Florida provides counseling services for students, staff, and faculty. See <http://www.counsel.ufl.edu/> or call (352) 392-1575 during regular service hours (8am – 5pm). For other hours or on weekends call the Alachua County Crisis Center (264-6789). Students may also call the clinician on-call at Student Mental Health for phone call back and consultation at (352) 392-1171.

### **Tentative Agenda**

#### **Week 1:**

Systems and Their Properties

The First Law: Energy Is Conserved.

Spontaneous, Reversible and Irreversible Processes

Energy transfer by work and heat

#### **Week 2:**

Entropy

The Second Law of Thermodynamics

Third Law of Thermodynamics

Enthalpy, Helmholtz and Gibbs energies

#### **Week 3:**

Criteria for Spontaneous Change

Equilibrium

Pure Substances in Single Phase

Chemical Potential

#### **Week 4:**

Phase Transitions

Mixtures

Activities

#### **Week 5:**

Electrolyte Solutions

Debye Hückel Theory

Mean Ionic Activities

**Week 6:**

Reactions and Chemical Processes  
Thermodynamics of Mixing  
Molar Reaction Enthalpy  
Gibbs Energy and Reaction Equilibrium  
Thermodynamic Equilibrium Constant

**Week 7:**

Phase Equilibria  
Gibbs Phase Rule

**Week 8-9**

Kinetics  
Reaction Mechanisms and Rate Laws  
Michaelis-Menten Kinetics

**Weeks 10-11:**

Transition-State Theory  
Examples of TS Theory

**Weeks 12-13:**

Applications to Biological Systems

**Weeks 14-15**

Term paper presentations