

# SYLLABUS

## Chemistry Concepts Contemporary Issues

CHEM-412 A

Spring 2016

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### Instructor Information

**Instructor's Name:**

Sandor Kadar, Ph.D.

**Instructor's Email:**

skadar@suffolk.edu

**Instructor's Phone:**

401-524-3425

**Instructor's Office Hours/Location:**

TUE/THU 8:00-9:30am, 12:00-2:00pm/SM815A (or by appointment)

**Anonymous Student Feedback Form:**

<https://www.surveymonkey.com/r/CHEM-412SP16SE>

### Course Information

**Course Meeting Time/Dates:**

TUE/THU 10:00-11:15 am.

**Course Location:**

SM320

**Course Catalog Description:**

Applications of thermodynamics to solutions, chemical equilibrium and electrochemistry; chemical kinetics will be covered. Quantum chemistry and the application of spectroscopy to molecular structure. 3 hours lecture.

**Course Prerequisites:**

CHEM-411 and concurrent enrollment in CHEM-412L

**Suffolk Credit Hours:**

3

**Fed. Govt. Credit Hour Definition:**

[http://cihe.neasc.org/downloads/POLICIES/Pp111\\_PolicyOnCreditsAndDegrees.pdf](http://cihe.neasc.org/downloads/POLICIES/Pp111_PolicyOnCreditsAndDegrees.pdf)

**Textbooks/Other Required Materials:**

- Chang: Physical Chemistry for the Chemical and Biological Sciences
- Clickers for the Class Response System (provided by instructor)
- Computer/Graphing calculator

## Course Goals and Learning Objectives

GOALS	OBJECTIVES	ASSESSMENTS
Upon successful completion of this course, students should be able to know/understand:	Upon successful completion of this course, students should be able to:	How the student will be assessed on these learning objectives:
The basis and theory of Chemical Equilibria	Correctly apply the theory of Chemical Equilibria to solve relevant problems including Electrochemistry and Acids/Bases	<ul style="list-style-type: none"><li>• Homework assignments</li><li>• Exams</li><li>• Classroom response system</li><li>• In-class pop-quiz</li><li>• Classroom performance assessment</li></ul>
The basis and theory of Chemical Kinetics	Correctly apply the Kinetic Theory of Gases, Chemical Kinetics and Enzyme Kinetics to solve relevant problems, including enzyme reactions	
The basis and theory at an introductory level of Quantum Mechanics	Correctly apply Quantum Mechanical principles to understand chemical reactivity and spectroscopy	
The foundation of Photochemistry and Photobiology	Correctly apply kinetics concepts to photo-induced chemical and biological processes	

### Course Policies

**Disability Statement:**

<http://www.suffolk.edu/disability>

**Absences and Attendance Policy from the Student Handbook:**

<http://www.suffolk.edu/studenthandbook/19864.php>

**Academic Integrity Policy (link):**

<http://www.suffolk.edu/studenthandbook/19863.php>

**Student Support/Mental Health:**

<http://www.suffolk.edu/campuslife/2752.php>

**Early Alert Statement:**

<http://www.suffolk.edu/academics/3057.php>

**General conduct:**

- Quizzes are administered at the beginning of classes, therefore late arrival will result in missing part (or all) of the quiz.
- The annotated PPT will be posted on BB for each class.
- Scientific calculators in class will be required, computers are recommended, as occasionally we will be working with relatively large data sets.
- Collaboration with each other or other individuals on any take-home assignments is not permitted, however notes, the text book, or any other posted materials on BB can be and should be used.
- Misses (classes, assignments, etc.) will be assessed on individual basis.
- I do encourage to use the [Student Feedback Form](#) if you have any concerns, problems related to the class, so I can make the appropriate changes in a timely manner. Every reasonable recommendation, suggestion will be brought to the class for discussion (<https://www.surveymonkey.com/r/CHEM-412SP16SE>)
- Cell phone use is limited to emergencies
- Using electronic devices for other purposes than associated with the class is strictly prohibited.

## Course Schedule

Date	Topic	Assessment	
Thu, 01/21	12.1 Reaction Rate 12.2 Reaction Order Zero-Order Reactions First-Order Reactions Second-Order Reactions Determination of Reaction Order 12.3 Molecularity of a Reaction Unimolecular Reactions Bimolecular Reactions Termolecular Reactions	Class Response System will be used in every class	
Tue, 01/26	12.4 More Complex Reactions Reversible Reactions Consecutive Reactions Chain Reactions Reaction Systems Coupled with Diffusion (Ca <sup>2+</sup> -dynamics of a cell)		
Thu, 01/28	12.5 Effect of Temperature on Reaction Rates The Arrhenius Equation 12.6 Potential-Energy Surfaces 12.7 Theories of Reaction Rates Collision Theory Transition-State Theory Thermodynamic Formulation of the Transition-State Theory		
Tue, 02/02	Chapter 13 Enzyme Kinetics 13.1 General Principles of Catalysis Enzyme Catalysis 13.2 The Equations of Enzyme Kinetics Michaelis-Menten Kinetics Steady-State Kinetics The Significance of K <sub>M</sub> and V <sub>max</sub>	Quiz (Chapter 12)	Homework (Chapter 12)
Thu, 02/04	13.4 Multisubstrate Systems The Sequential Mechanism The Nonsequential or "Ping-Pong" Mechanism 13.5 Enzyme Inhibition Reversible Inhibition Irreversible Inhibitions		
Tue, 02/09	13.6 Allosteric Interactions Oxygen Binding to Myoglobin and Hemoglobin The Hill Equation The Concerted Model The Sequential Model Conformational Changes in Hemoglobin Induced by Oxygen Binding 13.7 pH Effects on Enzyme Kinetics		
Thu, 02/11	Review	Quiz (Chapter 13)	Homework (Chapter 13)
Tue, 02/16	Chapter 19 Photochemistry and Photobiology 19.1 Introduction 19.2 Earth's Atmosphere 19.3 The Greenhouse Effect		

Date	Topic	Assessment	
Thu, 02/18	19.4 Photochemical Smog 19.5 The Essential Role of Ozone in the Stratosphere 19.6 Photosynthesis	Exam 1 (Chapters 12-13)	
Tue, 02/23	19.7 Vision 19.8 Biological Effects of Radiation		
Thu, 02/25	Chapter 14 Quantum Mechanics 14.1 The Wave Theory of Light 14.2 Planck's Quantum Theory 14.3 The Photoelectric Effect 14.4 Bohr's Theory of Hydrogen Emission Spectra 14.5 de Broglie's Postulate	Quiz (Chapter 19)	Homework (Chapter 19)
Tue, 03/01	14.6 The Heisenberg Uncertainty Principle 14.7 The Schrodinger Wave Equation 14.8 Particle in a One Dimensional Box Electronic Spectra of Polyenes 14.9 Quantum-Mechanical Tunneling	Class Response System will be used in every class	
Thu, 03/03	14.10 The Schrodinger Wave Equation for the Hydrogen Atom Atomic Orbitals 14.11 Many-Electron Atoms and the Periodic Table Electron Configurations Variations in Periodic Properties		
Tue, 03/08	Review	Quiz (Chapter 14)	Homework (Chapter 14)
Thu, 03/10	Catching up	Exam 2 (Chapters 14, 19)	
Tue, 03/15	Spring break		
Thu, 03/17	Spring break		
Tue, 03/22	Guest lecture		

Date	Topic	Assessment	
Thu, 03/24	Chapter 7 Nonelectrolyte Solutions 7.1 Concentration Units Percent by Weight Mole fraction (x) Molarity (M) Molality (m) 7.2 Partial Molar Quantities Partial Molar Volume Partial Molar Gibbs Energy 7.3 The Thermodynamics of Mixin 7.4 Binary Mixtures of Volatile Liquids	Class Response System will be used in every class	
Tue, 03/29	7.5 Real Solutions The Solvent Component The Solute Component 7.6 Phase Equilibria of Two-Component Systems Distillation Solid-Liquid Equilibria		
Thu, 03/31	7.7 Colligative Properties Vapor-Pressure Lowering Boiling-Point Elevation Freezing-Point Depression Osmotic Pressure		
Tue, 04/05	8.1 Electrical Conduction in Solution Some Basic Definitions Degree of Dissociation Ionic Mobility Applications of Conductance Measurements 8.2 A Molecular View of the Solution Process 8.3 Thermodynamics of Ions in Solution Enthalpy, Entropy, and Gibbs Energy of Formation of Ions in Solution	Quiz (Chapter 7)	Homework (Chapter 7)
Thu, 04/07	8.1 Electrical Conduction in Solution Some Basic Definitions Degree of Dissociation Ionic Mobility Applications of Conductance Measurements 8.2 A Molecular View of the Solution Process 8.3 Thermodynamics of Ions in Solution Enthalpy, Entropy, and Gibbs Energy of Formation of Ions in Solution 8.1 Electrical Conduction in Solution Some Basic Definitions Degree of Dissociation Ionic Mobility Applications of Conductance Measurements 8.2 A Molecular View of the Solution Process 8.3 Thermodynamics of Ions in Solution Enthalpy, Entropy, and Gibbs Energy of Formation of Ions in Solution		
Tue, 04/12	8.4 Ionic Activity 8.5 Debye-Huckel Theory of Electrolytes The Salting-In and Salting-Out Effects 8.6 Colligative Properties of Electrolyte Solutions The Donnan Effect 8.7 Biological Membranes Membrane Transport		

Date	Topic	Assessment		
Thu, 04/14	Review	Class Response System will be used in every class	Quiz (Chapter 8)	Homework (Chapter 8)
Tue, 04/19	Chapter 9 Chemical Equilibrium 9.1 Chemical Equilibrium in Gaseous Systems Ideal Gases Real Gases 9.2 Reactions in Solution 9.3 Heterogeneous Equilibria			
Thu, 04/21	9.4 The Influence of Temperature, Pressure, and Catalysts on the Equilibrium Constant The Effect of Temperature The Effect of Pressure The Effect of a Catalyst 9.5 Binding of Ligands and Metal Ions to Macromolecules One Binding Site per Macromolecule n Equivalent Binding Sites per Macromolecule Equilibrium Dialysis		Exam 3 (Chapters 7-8)	
Tue, 04/26	No class			
TBA	<b>Final Exam</b>			

**Note:**

- Every effort will be made to keep the schedule, however it is subject to unexpected circumstances. Notification will be sent out via email in case there is any change
- From class-to-class minor changes may happen depending on how the class dynamics unfolds. If any of these changes impact grading, proper timely notification will be sent out via email

**Assessment:**

**Quizzes:**

- In-class quizzes with clickers
- Format is multiple choice, 5 questions
- Each question is typically not more than 2 min, timed with countdown
- Total of 6, lowest grade dropped
- Average of 5 highest will be considered
- No makeup offered

**Homework Assignments:**

- Posted on BB, has to be submitted on BB
- Typically 5 questions each
- Can be completed on paper
- Due dates are shown in the Course schedule

- Late submission is accepted up to 2 days with 25% penalty
- Total of 6, lowest grade dropped
- Average of 5 highest will be considered

**Exams:**

- Posted on BB
- Due dates are shown in the Course schedule
- Late submission is accepted up to 2 days with 25% penalty
- Total of 3, lowest grade dropped
- Average of 2 highest will be considered
- Grade for the Final Exam replaces all Exam grades that it exceeds

**Final Exam:**

- In class exam (location TBD)
- Can be omitted/missed, grades will be the average of all three Exam grades
- No makeup is offered

*Class activity (clickers):*

- PowerPoint presentations will contain slides with multiple choice questions to be answered with the clickers
- Each class is considered one session, the one with a lowest grade will be dropped

**Class activity:**

- Given by the instructor based on performance in the class

**Class activity (with Class Response System):**

- Collected responses in each class constitute a "Session" resulting in one percent grade
- Grade for one session will be dropped (for a missed class or the lowest)
- Average of the remaining grades will be calculated

**Attendance (in addition to University policies):**

- Attendance is required
- One class can be missed, each subsequent miss will lower the Attendance grade by 1% until the 10% is exhausted
- Attendance is automatically registered with the clickers

**Grading:**

Assessment type	Contribution to final grade
Quizzes	15%
Homework Assignments	15%
Exams	20%
Final Exam	20%
Class Activity (clickers)	10%
Class Activity	10%
Attendance	10%