Chemistry 112  Principles of Chemistry  Spring 2013

Instructor: Dr. Amy L. Rogers  
Office: 308 School of Science and Mathematics Building  
Telephone: 953-7292  
Email: rogersal@cofc.edu  
Office Hours: By appointment

Learning Outcomes: (1) Demonstrate competency with all of the learning objectives stated for Chem 111 and Math 111 (2) Apply common mathematical techniques to describe the kinetic and thermodynamic processes related to chemical equilibria.

Required Materials: Chemistry, Atoms First, 1st ed., Burdge and Overby

Calculators: You will need a calculator that performs exponential and logarithmic functions. You will need to bring it to all class meetings.

Prerequisite: A basic working knowledge of general algebra and Chemistry 111.

Lecture: 11:00-11:50, MWF, Lightsey 344. Please be prompt.

Lab: Please make sure that you are registered for a Chemistry 112 laboratory, unless you have already passed the lab but failed the lecture. You must wear closed-toed shoes, long pants (new policy), shirts with sleeves and proper eyewear during lab. Labs start the week of January 14.

Attendance: Attendance is mandatory. Extreme circumstances (i.e., C of C sports/group event, medical problem, etc.) must be excused by proper documentation.

Participation: I expect everyone to participate in class. This is the only way that I can evaluate the general understanding of the class. Participation will help determine grades of students on the borderline.

Notes: All PowerPoint slides will be provided to the student and can be found on the OAKS website for this course. The notes are not intended to cover all the material discussed in class as there are many calculations that will be done in class that are not covered in the slides.

Homework: Homework will be assigned throughout the semester. Homework might be periodically graded but used mostly for discussion/calculations during class.

Tests: There will be four exams throughout the semester. The dates set for the exams are:

Exam I: Monday, January 28
Exam II: Monday, February 25
Exam III: Monday, April 1
Exam IV: Wednesday, April 24
**Final Exam:** The final exam will be comprehensive. It is the American Chemical Society standardized test for second semester general chemistry. Final exam is on Friday, May 3, 2013 at 8:00 am. Please plan accordingly.

**Make-ups:** Tests may only be made up if appropriate documentation is presented and approved by undergraduate studies, the chairman of the chemistry department, and myself.

**Chapters of Study (in order of lecture)**

- Intermolecular Forces: Chapter 12
- Solutions: Chapter 13
- Equilibrium: Chapter 15
- Solubility Equilibria Chapter 17.4-17.5
- Acid/Base: Chapter 16
- Acid-Base Equilibria Chapter 17
- Chemical Kinetics: Chapter 14
- Entropy, Free Energy, and Equilibrium Chapter 18
- Electrochemistry: Chapter 19
- Nuclear Chemistry Chapter 20

**Grading:**

- Four Exams 400 points
- Final exam 150 points
- Total points 550 points

**Grading Scale:**

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**Important Dates to Remember:**

- Jan. 9 First day of classes
- Jan. 21 Martin Luther King holiday – No class
- Mar. 4-10 Spring Break
- Mar. 25 Last day to withdraw from classes with grade of “W”
- April 24 Last day of class
- May 3 Final Exam
**Academic Dishonesty:**
Cheating will not be tolerated in this course. The following description of cheating is from the student handbook:

“the actual giving or receiving of unauthorized, dishonest assistance that might give one student an unfair advantage over another in the performance of any assigned, graded academic work, inside or outside of the classroom, and by any means whatsoever, including but not limited to fraud, duress, deception, theft, talking, making signs, gestures, copying, electronic messaging, photography, unauthorized reuse of previously graded work, and unauthorized use or possession of study aids, memoranda, books, data, or other information. The term cheating includes engaging in any behavior specifically prohibited by a faculty member in the course syllabus or class discussion.”

For this course, entering formulas into a calculator to be used during an exam will be considered as an act of premeditated cheating.

Students that cheat and are then prosecuted through the Honor Board receive a grade of XF. This does not look good to all future employers and graduate programs. It is infinitely better to get an F than an XF.

**Disabilities:** If there is a student in this class who has a documented disability and has been approved to receive accommodations through SNAP Services, please feel free to come and discuss this with me.
Chapter 12 Intermolecular Forces and the Physical Properties of Condensed Phases
- Describe intermolecular forces and their relative strengths.
- Describe intermolecular forces and their effect on liquids and gases.

Chapter 13 Physical Properties of Solutions
- Describe important factors in the solution process.
- Express concentrations in mass percent, parts per million, mole fraction, molarity, and molality.
- Predict the effect of pressure and temperature on solubility.
- Use Raoult's law in vapor pressure lowering and distillation problems.
- Use boiling point elevation and freezing point depression to determine molar mass.
- Calculate osmotic pressure.
- Explain what colloids are.
- Relate the effect of colligative properties.

Chapter 14 Chemical Kinetics
- Determine rate laws using the method of initial rates.
- Determine first order rate laws from data.
- Relate rate laws to reaction mechanisms.
- Draw reaction pathway diagrams illustrating catalysis pathways and activation energy.
- Use the Arrhenius equation to calculate rate constants at different temperatures.
- Explain the effect of heterogeneous and homogeneous catalysis.
- Relate the role of enzymes to rates and selectivity of reactions.

Chapter 15 Chemical Equilibrium
- Calculate equilibrium constants and equilibrium concentrations.
- Predict effects on equilibrium using LeChatelier's Principle.

Chapter 16 Acids and Bases
- Describe Brønsted acids and bases.
- Discuss the acid-base properties of water.
- Recognize strong acids and bases.
- Recognize weak acids and bases.
- Calculate the pH, pOH, [H+], [OH-], and dissociation constants for acid-base, salt, and buffer solutions.
- Know the relationship between conjugate acid-base pairs.
- Work with diprotic and polyprotic acids.
- Recognize and use the acid-base properties of salt solutions.
- Describe Lewis acids and bases.

Chapter 17 Acid-Base Equilibria and Solubility Equilibria
- Describe the common ion effect in equilibria.
- Describe buffer solutions.
- Calculate the pH of a buffer solution.
- Describe how to prepare a buffer solution with a specific pH.
- Calculate acid-base titrations.
- Calculate concentrations, solubilities, and solubility product constants for slightly soluble compounds.
- Describe the qualitative analysis of metal ions in solution using differences in solubility.
- Calculate concentrations, solubilities, and formation constants for complex ions.

Chapter 18 Entropy, Free Energy, and Equilibrium
- Relate the first, second, and third laws of thermodynamics to spontaneous processes.
- Calculate and interpret enthalpy, entropy, and free energy changes for chemical systems.
- Calculate equilibrium constants from thermodynamic data.
- Explain the role of thermodynamics in living systems.

Chapter 19 Electrochemistry
- Balance oxidation-reduction reactions.
- Draw and explain processes in galvanic, voltaic, and electrolytic cells.
- Use the Nernst equation to calculate cell potentials.
- Calculate cell emf, concentrations, equilibrium constants, enthalpy, and entropy using electrochemical methods.
- Calculate stoichiometric quantities in electrolytic processes.
- Relate electrochemical theory to the storage of energy.

Chapter 20 Nuclear Chemistry
- Describe and predict radioactive processes using nuclear equations.
- Use first order kinetics in radiocarbon dating and other decay processes.
- Calculate the mass defect, and binding energy, of nuclei.
- Describe nuclear fission and fusion processes and calculate the associated energy changes.
- Discuss the role of radioactive isotopes in medicine and the environment.