Analysis of Equilibrium Systems
CHEM 2011-1
Winter Quarter, 2010

Instructor: Dr. Todd A. Wells
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Class Time: MWRF, 9:00 - 9:50AM
Class Location: Olin 105
Office Hours: MWR, 11:00 AM - 12:00 PM

REQUIRE COURSE ITEMS

Textbook: *Quantitative Chemical Analysis,* 7th ed., by Daniel C. Harris

Calculator: An inexpensive calculator is required. It should have the capabilities for square roots, logarithms, and exponential (scientific) notation operations. **Remember to bring your calculator (or laptop) with you to every class.**

SUPPLEMENTAL COURSE ITEMS

Chemistry, 4th or 5th eds., by Martin S. Silberberg (textbook used for CHEM 1010).
Solutions Manual of Quantitative Chemical Analysis, 7th ed., by Daniel C. Harris

COURSE DESCRIPTION

Analysis of Equilibrium Systems is the fifth course in the six quarter freshman/ sophomore chemistry sequence. The course is an introduction to chemical equilibria and kinetics. Chemical equilibria will focus on aqueous systems, starting first with simple systems. Discussions will progress to advanced applications of complex equilibria, including examples from biological and environmental systems.

LECTURE

The format of class meetings will follow traditional lecture format on MWF. I will summarize new material and present illustrations and examples. In lecture, I WILL NOT identify and describe every detail you will read in the text and any supplemental materials. I will, however, emphasize the important topics covered in the reading as well as problem solving strategies when appropriate. You should stop me at any time if you have questions about the material being covered.

The Thursday (R) class meetings will be devoted to quizzes, problem solving, and group activities. No new lecture material will be covered on these days. However, material from the lecture will be explored in greater detail. A short quiz may be administered at each meeting. We will work on specific "challenge problems" in small groups, go over spreadsheet applications, and after the hour exams, complete exam keys. If time permits, we will go over any questions you have on the material covered in lecture or homework problems.

READING

You are expected to complete the assigned reading prior to the class lecture. After lecture, you should reread the assigned text. In addition, you are also encouraged to attempt the "Ask Yourself exercises throughout the text while you are completing your assigned reading. I recommend that you understand the material and how to solve the sample problems before proceeding to the next section. At the end of each chapter, a summary of important equations and terms is provided that should prove helpful in the preparation for quizzes and exams.

PROBLEMS

Problem solving is an important component of all chemistry and most science courses. For most students, successfully solving problems requires practice. I strongly suggest that you complete the suggested problems that will be posted. While you are not required to turn the completed problems in for a grade, I highly recommend that you attempt all of them. These problems are typical of those you might encounter on quizzes and exams.

GRADED EXERCISES
The suggested problems will not be graded. Challenge problem sets, however, will be assigned during the course that will be graded. These problems are more difficult than the suggested problems, and will require significant effort on your part. You will work together in small groups to complete the problems. The completed exercise will be handed in for a grade.

QUIZZES/EXAMS
Quizzes will be administered weekly on Thursday or Friday, with the exception of the class meetings following the hour exams. The quizzes will be short (10 - 15 minutes), and will cover material from the preceding 3 - 4 lectures. A significant portion of each quiz will cover material that I have covered in lecture and material that you have seen during group work. The quizzes will be similar in nature to assigned (problem sets) and suggested homework problems. An estimated seven (7) quizzes will be given throughout the course. Your 2 lowest quiz scores will be dropped and only the scores on the remaining quizzes will comprise the "Quiz" portion of your final grade.

Three (3) exams will be given during the quarter two hour exams and a final exam. Exam problems will be similar to the problems given in the weekly quizzes and to those found on the problem sets.

If you will be out of town for a University sanctioned function (e.g., athletic team or music group), you are responsible for making arrangements with Dr. Wells at least one week in advance to take the quiz or an hour exam early. **THERE WILL BE NO MAKE-UP QUIZZES OR EXAMS.**

GRADES
Your final grade will be determined by the percentages with the following components:

Group Work/Graded Exercises	12%
Quizzes	22%
Hour exams	44%
Final exam	22%
Total	100%

ACADEMIC DISHONESTY
While I advocate collaborative learning and teamwork, I also firmly believe that each individual should maintain the highest ethical standards in all of life's endeavors. As such, I support and will strictly enforce the Honor Code of the University of Denver. I have included the links for the Honor Code Statement and Honor Code Procedures for Students below. For further information, please see the Office of Citizenship & Community Standards' website at http://www.du.edu/honorcode/statement.htm for the Honor Code Statement and at http://www.du.edu/honorcode/studentprocedure.htm for the Honor Code Procedures for Students.

TENTATIVE SCHEDULE

Date	Topic	Reading
Jan. 4	Introduction; Units; Solutions	QCA: 9-14
Jan. 6	Solutions cont.; Preparing solutions	QCA: 14-15
Jan 7	Sig Figs	QCA: 39-41
Jan. 8	Sig Figs cont.; error	QCA: 42-44, 53-62, 65
Jan. 11	Error, statistics	QCA: 42-44, 53-62, 65
Jan. 13	Error, Intro to Equilibrium	QCA: 97-100
Jan. 14	Group Work	
Jan. 15	Equilibrium cont. Volumetric analysis	QCA: 97-100, 121-125
Jan. 18	MLK Holiday - DU Holiday - No Class	
Jan. 20	Acids and bases	QCA: 105-112,159-160

Jan. 21	Group work	
Jan. 22	Weak acid / weak base Equilibria	QCA: 161-167
Jan. 25	Weak acid / weak base Equilibria cont., Buffers	QCA: 161-167,167-171
Jan. 27	Preparing buffers	QCA: 172-176
Jan. 28	Group work	
Jan. 29	**Hour Exam I**	
Feb. 1	Strong acid/base titrations	QCA: 199-212
Feb. 3	Weak acid/base titrations	QCA: 199-212
Feb. 4	Weak acid/base titrations, cont.; endpoints	QCA: 199-206
Feb. 5	Indicators	QCA: 212-216
Feb. 8	Polyprotic acids and bases	QCA: 181-189
Feb. 10	Principle species; Titrations of polyprotic systems	QCA:190-192, 206-208
Feb. 11	Group Work	
Feb. 12	Solubility product	QCA: 100-104, 131-132
Feb. 15	Ionic strength; Activity coefficients	QCA:141-147
Feb. 17	Systematic treatment; Fractional composition	QCA: 147-154
Feb. 18	Group work	
Feb. 19	EDTA titrations	QCA: 228-246
Feb. 22	Chemical kinetics – reaction rates	S: 684-691
Feb. 24	Chemical kinetics – rate laws	S: 691–705
Feb. 25	Group Work	
Feb. 26	**Hour Exam II**	
Mar. 1	Chemical kinetics – rate laws cont.	S: 691–705
Mar. 3	Chemical kinetics – temperature/concentration	S: 705-714
Mar. 4	Group Work	
Mar. 5	Chemical kinetics – mechanisms/catalysis	S: 714-722
Mar. 8	Chemical kinetics - mechanisms/catalysis cont.	S: 714-722
Mar. 10	Review	
Mar. 13 (10:00 – 11:50 am)	**Final**	

QCA - Quantitative Chemical Analysis; S - Silberberg