


**Analysis of Equilibrium System
CHEM 2011-1 (CRN 1607)
Winter Quarter, 2016**

Instructor: Dr. J. Alex Huffman
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Class Time: MWF, 8:00 – 8:50 AM – Boettcher Center Auditorium (BAUD) 101
Recitation: Tu, 8:00 – 8:50 AM – Olin 105
Office Hours: MTuW 09:00 – 10:00 AM (may be changed *with* notice)
Help Room: Staffed by learning assistants (LAs) throughout the week in Anderson Academic Commons.
See here for more information and schedules: <http://portfolio.du.edu/sec>  @SELCatDU

REQUIRED COURSE ITEMS

Textbook: *Quantitative Chemical Analysis*, 9th Ed., by Daniel C. Harris; Freeman Publ. (QCA)
Textbook: An additional General Chemistry text will be required, and any modern text will be sufficient. I will assign supplemental reading assignments out of: *Chemistry* OpenStax College, 1st Ed. Textbook content produced by OpenStax College is licensed under a [Creative Commons Attribution License 4.0](https://creativecommons.org/licenses/by/4.0/) license. This means you can access the text for free here: <https://openstaxcollege.org/textbooks/chemistry>
Sapling: Homework will be performed online using the *Sapling* system. This is required for purchase (\$36 for the quarter). More details will be given on the first day of class. <http://saplinglearning.com>. For any problems: support@saplinglearning.com
Calculator: You will need an inexpensive calculator that has the capability for square roots, logarithms, and exponents. You are responsible for understanding how to perform these operations on your calculator. **Please bring your calculator with you to every class.** Electronics with WiFi (laptops, cell phones, etc.) will NOT be allowed during exams or quizzes.

SUPPLEMENTAL COURSE ITEMS (Optional)

Solutions Manual: *Solutions Manual for Quant. Chemical Analysis*, 9th Ed., D. 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 simple aqueous systems, starting with simple systems. Discussions will progress to advanced applications of complex equilibria, including examples from biological and environmental systems.

Please pace yourself and work continuously. Even if you think a topic is easy I recommend that you put in time to make sure you understand details not discussed in lecture. Working more steadily will show both better results and lower stress! Students are expected to put in 2-3 hours outside of class per course credit hour. This means that for CHEM 2011 you should be prepared to spend ~6-9 hours outside of class per week.

Student perspectives of this course vary widely, from some who think it is very easy to others who think it is very difficult. Many who struggle in the course are nervous about or weak in math skills. No math skills beyond basic algebra will be required, but if you think you need help in this area I highly recommend that you seek a tutor or utilize the math help center early so that simple math will not limit you. In all cases, even well prepared and experienced students will find that practicing problems will be critical to success in the course.

COURSE OBJECTIVES & KEY SKILLS

- Understand the sources of error and uncertainty in chemical analysis
- Identify chemical species that exist in aqueous solutions based on equilibria principles
- Understand the significant role equilibria has on biological and environmental systems
- Understand principles and applications of zero- and first-order reaction kinetics
- Understand quantitative relationships in chemical reactions such as complex formation and acid-base neutralization
- Understand relationships between equilibria and other chemical/physical properties such as free energy, activity, and ionic strength
- Understand and apply basic skills of scientific information literacy, including the use of literature database tools, access rights, and citation requirements
- Use Excel to calculate concentrations of chemical species in solution, and thus facilitate the understanding of both simple and complex equilibria
- Practice systematic logic and problem-solving


LECTURE

The format of the class meetings will follow traditional lecture format on MWF. I will summarize new material and present illustrations and examples. You will be encouraged to practice problems during and after lectures. I will NOT be able to identify and describe every detail you read in the text and any supplemental materials. You will be expected to finish and understand assigned readings even if I have not gone over that material in great detail. However, I will emphasize important topics covered in the reading as well as problem solving strategies when appropriate. Please stop me at any time if you have questions.

The Tuesday (Tu) recitation meeting will be devoted to review, problem solving, group activities, in-class assignments and quizzes. No new lecture material will be covered on these days. However, material from the lecture will be explored in greater detail. *Assignments for credit may be given and worked during recitation.*

OFFICE HOURS & HELP CENTER

I have posted hours when I will be available in my office for questions or issues related, or unrelated, to the course. These hours may be changed, if necessary, during the quarter, but this will be announced.

Need extra help? The *Science and Engineering Learning Center* is a collaborative space staffed by undergraduate and graduate learning assistants (LAs) trained to assist students with some first and second year biology, chemistry, physics, computer science and engineering courses. They offer support for both lecture and laboratory courses for certain courses, CHEM 2011 included. Their goal is to help students grow as problem solvers by assisting with homework sets, lab reports, and preparing for exams. The Science and Engineering Learning Center is **not** a one-on-one tutoring center, but is rather a support system where students can get guidance from LAs as well as their peers. This center is open to all DU students. All services are free. Located in the north-west corner of the first floor of the Anderson Academic Commons (west of the writing center). See <http://portfolio.du.edu/sec> for a complete schedule. Please also follow them Twitter for the most up-to-date announcements:  @SELCatDUREADING

You are encouraged to complete the assigned reading prior to the class lecture and often again after the lecture. In addition, you are also encouraged to attempt the example exercises throughout the text while completing the 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 preparation for quizzes and exams.

SAPLING ASSIGNMENTS

Homework problems will be assigned to be worked and turned in online using the Sapling system (<http://saplinglearning.com>). These assignments will be worth 15% of your course grade. A tech TA supplied by Sapling will be able to answer your technical questions about log-in issues or non-academic problems with homework questions. Email: support@saplinglearning.com and not Dr. Huffman for help with these issues.

A total of approximately ten Sapling homework sets will be assigned throughout the quarter, with due dates generally at 6 PM on Friday of each week. The assignments will lock exactly when they are due, so plan ahead. Late assignments may NOT be accepted for any credit. In some circumstances an assignment *may* be accepted, but with significant grade penalty. Computer or internet problems are not valid excuses for lateness.

I have found that Sapling can be a good tool for learning, but only if utilized properly. You are welcome to work on assignments with other classmates, but it is critical that you understand and practice how to independently work all problems from beginning to end. Students who have relied too heavily on group Sapling sessions in the past have performed poorly on exams and in the course.

OTHER GRADED ASSIGNMENTS

Supplementary challenge problems will be assigned periodically during the course to be turned in for a grade. Some of these will be individual efforts and others will require group work. These problems will be more difficult than the suggested book problems, and may require significant effort on your part. These problems may be assigned for completion during recitation periods or for completion out of classroom hours. Quizzes may also be given during Tuesday recitations.

This quarter you will be asked to create an infographic similar to infographics found at www.compoundchem.com. For this infographic you will work in pairs. The details of this assignment will be discussed in recitation and can be found on canvas.

NON-GRADED PROBLEM SETS

Problem solving is an important component of all chemistry and most science courses. For most students, successfully solving problems requires practice. In addition to completing the example exercises in the text, I will post problem sets to help you practice. These will not be graded, but the solutions will also be posted. Exam questions may be taken from, or may closely follow these problem sets. I strongly suggest that you consider these as mandatory work and I recommend that you finish all of them. In some cases during office hour discussions I may suggest that you complete these problems before I answer your questions in detail.

EXAMS

Four (4) exams will be given during the quarter: three hour exams and a final. Exam problems will be similar to those given in the weekly homework and to those found on the problem sets. The lowest score from the three hour-exams will be automatically dropped, and only the top two (2) hour-exam scores will be counted towards the final course grade. **Under NO circumstances may the final be dropped or taken early.**

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. Huffman at least one week in advance to take an hour exam early. **Only in extremely extenuating circumstances, and with required documentation (e.g., letter from Student Health), will a make-up hour exam be given.**

GRADES

At the end of the quarter, you will be graded according to your performance on assignments and examinations. Cooperative learning is encouraged. Your final grade will be determined by the percentage with the following components and scale. I will not grade on a curve, but grades in both course sections will be monitored and may be slightly increased if necessary in some cases.

Component	Percentage
Sapling (online) Homework	15%
Additional Assignments	15%
Hour Exams (top 2 scores at 20% each)	40%
Final Exam	30%
<i>Total</i>	<i>100%</i>

Grade	Percentage
A	93.0 - 100
A -	90.0 - 92.9
B +	87.0 - 89.9
B	83.0 - 86.9
B -	80.0 - 82.9
C +	75.0 - 79.9
C	69.0 - 74.9
C -	65.0 - 68.9
D +	62.0 - 64.9
D	58.0 - 61.9
D -	55.0 - 57.9
F	< 54.9

IMPORTANT DATES

January 4: Classes begin, Winter Quarter

January 10: Last day to drop classes without permanent record

January 18: Martin Luther King Holiday (no class)

* February 25: Last day to drop (for “W”), requires approval (8th week)

March 9: Last day of classes

March 10 (THURSDAY): Final Exam, 8:00 – 9:50 AM

DU Academic Calendar: <http://www.du.edu/registrar/media/documents/academic-calendars/2014calendar.pdf>

CELLULAR PHONE AND MOBILE DEVICE POLICY

I respect the need for each individual to stay in contact with family and friends. The use of mobile devices, however, is disruptive to the learning environment. Thus, I request that the ringers of all cellular phones and other mobile devices be muted during class. If an emergency arises, and you need to make a call on your phone, I request that you quietly leave the room and conduct your conversation out in the hallway.

LECTURE AND TESTING ACCOMMODATIONS

I will make every effort to accommodate students diagnosed with a learning disability. I will do this in complete confidence. I request that any student requiring these accommodations inform me the first week of class. For further information, please see the University Disability Services’ website:

<http://www.du.edu/disability/dsp/index.html>.

RELIGIOUS ACCOMMODATION

University policy grants students excused absences from class or other organized activities or observance of religious holy days, unless the accommodation would create an undue hardship. Faculty are asked to be responsive to requests when students contact them *in advance* to request such an excused absence. Students are responsible for completing assignments given during their absence, but should be given an opportunity to make up work missed because of religious observance.

Once a student has registered for a class, the student is expected to examine the course syllabus for potential conflicts with holy days and to notify the instructor by the end of the first week of classes of any conflicts that may require an absence (including any required additional preparation/travel time). The student is also expected to remind the faculty member in advance of the missed class, and to make arrangements in advance (with the faculty member) to make up any missed work or in-class material within a reasonable amount of time.

See: http://www.du.edu/studentlife/religiouslife/DU_religious_accommodations_policy.html

ACADEMIC DISHONESTY & STUDENT SUPPORT

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. See links for specific links below:

Pioneer Pledge: <http://www.du.edu/studentlife/ccs/pledge.html>

Honor Code Statement: http://www.du.edu/studentlife/ccs/honor_code_2011-2012.pdf

I also understand that every student has unique personal and educational needs. I will do my best to help you learn or appropriately facilitate your ability to work through personal issues. Please see the Office of Student Life (<http://www.du.edu/studentlife/ccs/index.html>), including the Pioneer Care program (<http://www.du.edu/studentlife/care/>), for more detailed resources.

TENTATIVE SCHEDULE

	Week #	Lecture #	Date	Week-day	Topic	Reading Section	Sapling: Lectures Covered	Assignments	
								Due Date (6 PM)	Additional Assignment (Tentative)
EXAM #1 Material	1	1	Jan 4	M	Course overvie; Types of Error	3.1-3.3	#1		
		R1	Jan 5	Tu	Recitation: Chemistry math review; Excel Intro	1.1, 2.10-2.11			Review Quiz
		2	Jan 6	W	Gaussian Distribution; Conf. Intervals	4.1-4.3			
		3	Jan 8	F	Calibration Curves	4.4-4.9		Sapling #1	
	2	4	Jan 11	M	Reversibility; Introductio to equilibrium	6.1	#2		
		R2	Jan 12	Tu	Recitation: Science Librarian lecture				Gaussian Sheet
		5	Jan 13	W	Reaction quotient: Q; Thermodynamics	6.2		Sapling #2	
		6	Jan 15	F	Disturbing equilibrium (Le Chat)	6.2			
	3	-	Jan 18	M	MLK Jr. Holiday - Official DU Holiday - No Class	-	#3		
		R3	Jan 19	Tu	Recitation				
		7	Jan 20	W	ICE Tables; Solubility Product	6.3 + OS: 15.2			
		8	Jan 22	F	Ksp; Common Ion Effect; Precipitation	6.3		Sapling #3	
EXAM #2 Material	4	9	Jan 25	M	Acid/Base, pH review; Water autoprotolysis	6.5-6.7 + OS: 14.2-14.4	#4		
		R4	Jan 26	Tu	Recitation				
		E	Jan 27	W	EXAM #1 (covers lectures #1-6)				
		10	Jan 29	F	Weak acids; pKa; conjugates	6.7		Sapling #4	
	5	11	Feb 1	M	Introduction to Titrations	7.1-7.5	#5		
		R5	Feb 2	Tu	Recitation				
		12	Feb 3	W	Activity	8.1-8.3			
		13	Feb 5	F	Systematic treatment of equilibria	8.4-8.5, 9.1		Sapling #5	
	6	14	Feb 8	M	Weak acid/base equilibria	9.2-9.4	#6		
		R6	Feb 9	Tu	Recitation				
		15	Feb 10	W	Buffers (definition; H-H equation)	9.5			
		E	Feb 12	F	EXAM #2 (covers lectures 7-13)				
EXAM #3 Material	7	16	Feb 15	M	Buffers (adding acid/base, preparing)	9.5	#7	Sapling #6	
		R7	Feb 16	Tu	Recitation				Systematic Equil.
		17	Feb 17	W	Diprotic acids/bases	10.1			
		18	Feb 19	F	Diprotic buffers; Triprot. acids/bases; Princ. species	10.2-10.5		Sapling #7	
	8	19	Feb 22	M	Titrations: Strong acid/weak acid + strong base	11.1-11.2	#8		
		R8	Feb 23	Tu	Recitation				
		20	Feb 24	W	Titrations: Weak base + strong acid; trends	11.3-11.4			
		21	Feb 26	F	Kinetics: introduction & reaction rates	OS: 12.1-12.3		Sapling #8	
	9	E	Feb 29	M	EXAM #3 (covers lectures 14 - 20)		#9		
		R9	Mar 1	Tu	Recitation				Titrations Excel
		22	Mar 2	W	Kinetics: rate laws	OS: 12.4			
		23	Mar 4	F	Kinetics: integrated rate laws	OS: 12.5		Sapling #9	
Material on Final	10	24	Mar 7	M	Kinetic theories and mechanisms	OS: 12.6-12.8	#10		
		R10	Mar 8	Tu	Recitation			Sapling #10	
		25	Mar 9	W	Course review	-			
		-	Mar 10	Th	(Cumulative) FINAL EXAM, 8:00 - 9:50 AM				

Important Notes:

- Schedule is approximate. Dates of hour exams may be changed, but *with* appropriate notice.
- Information literacy assignment will be due approximately during the 7th week of the quarter