

Chemistry 300L
Fall 2010

ANALYTICAL CHEMISTRY

Lecture: 10:00-10:50 MWF, SGM 601

Instructor

Prof. Thomas C. Flood

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Office Hours: Monday 5:00-6:00 and Wednesday 12:00-1:00, and by appointment

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Course Web Site: <http://www-scf.usc.edu/~chem300/>

Textbook: *Quantitative Chemical Analysis, 7th Edition*, by Daniel C. Harris, W. H. Freeman and Co., 2006, ISBN: 0-7167-7041-5. *Harris* is a well-organized book and we will follow it closely for most of the course, although the chapters will be covered out of order. If you master this book, you will master the course. The *Solutions Manual for Quantitative Chemical Analysis 7th Ed.* (ISBN 0-7167-7260-4) is helpful and it's purchase is strongly recommended (or share a copy with friends). The book also has an associated web site at <http://bcs.whfreeman.com/qca7e/>. Web-quizzes and other "goodies" will be found at this web site. You are encouraged to use these resources.

Reading Assignments: Lectures are designed to help you understand the material presented in the textbook. To get the most out of lecture one should always read the appropriate sections before they are discussed in class. A tentative schedule of lecture topics is given below and will be posted on the course website. You should read the first four chapters (Ch. 0-3) in *Harris* right away. We will go through this introductory material quickly.

Harris has over 650 pages, and some decisions have been made regarding the scope of a one-semester course. In the interests of the biochemistry curriculum and to modernize the course, we have kept coverage of traditional methodology limited to about one-third of the semester and have given spectroscopy and chromatography (instrumental analysis) more emphasis. Chapters to be covered and their order of discussion are listed on pages 5 and 6 of this *Syllabus*. In addition, handouts dealing with Fourier transform NMR spectroscopy will be given out. *This scope requires covering one chapter in one or two lectures for most of the semester.* Fortunately, the chapters are short and readable, and have lots of examples. The book is well suited to this pace.

Homework Assignments: Homework assignments consisting of Problems assigned for each chapter will be posted on the course website. These will not be collected or graded, but you must do them promptly to stay on track in CHEM 300.

CHEM 300 requires working a lot of numerical problems, particularly in chapters 1-12. This is one of those facts of life; it is the same in similar courses at other universities. For those of you not taking physical chemistry, this will be the chemistry course with the most quantitative challenges. These problems are not demanding in terms of math skills; typically they require solving only simple algebraic expressions. The challenge comes from the need to understand chemical principles and to apply them in order for you to “set up” the problem and obtain the correct answer. In some cases, such as titrations, the problem that must be solved is repetitive in nature and can be done conveniently using spreadsheet programs such as Excel[®]. *Harris* emphasizes the use of spreadsheets, and you are strongly encouraged to become thoroughly familiar with one of these programs. A tutorial on how to use several useful functions in Excel can be given if you request it.

However you choose to do them, you will need to work a lot of homework problems to become proficient. You will be required to work some problems, in effect, for every lecture.

There are three kinds of problems in *Harris*. Examples appear in the text during the presentation of material. When you encounter one of these, pick up a pencil and paper and work through it until you understand it. Don't simply read it. A set of Exercises and a set of Problems are found at the end of each chapter. Fully worked solutions to Exercises and answers (but not worked solutions) to Problems are at the end of the book. The *Solutions Manual*, mentioned above, contains worked solutions for all of the Problems in the book. Again, working problems with pencil and paper is the most effective way to solidify your understanding after you read the text and study your class notes. If you cannot work a problem, review the relevant sections of the textbook and your notes. It is especially *ineffective* to simply read the answer in the back of the book or from the *Manual* and think “Yes, I could have done that.” Consult the back of the book or the *Manual* as a last resort or to check answers of which you are confident. If you still don't understand the problem, seek assistance from the lecturers or the TA's.

Each chapter also has Terms to Understand. You are responsible for all Terms to Understand in assigned chapters. These are introduced in the text and also defined in a Glossary at the end of the book. Terms to Understand will appear on all tests either explicitly or in the wording of problems. Acquiring the vocabulary of the trade is one of the most important aspects of any course.

Exams: There will be three Exams each worth 100 points. Exams 2 and 3 will be cumulative only in the sense that knowledge of material from previous chapters is assumed in the design of questions for current examination material. The Final Exam will comprise ~50% Hour Exam 4 and ~50% review of material from the first three exams. It will total 200 points. The total for the lecture part of the course (500 points) will be normalized to 55% of the total course grade.

No make-up exams can be given in this course. Absences will be excused only for medical reasons or in the case of extreme necessity. Written excuses or student health center slips must be presented to a lecturer for approval and should be secured in advance whenever possible. In the case of an excused absence, a grade will be assigned which is based on the average of the student's class rank on the other three exams. Any unexcused absence will result in a grade of

zero for that exam. Requests for regrading of any exam must be submitted within one week after the graded exam is made available to you. Exams submitted for regrading may be regraded in their entirety at the lecturer's discretion. *Graded exams may be photocopied before redistribution.* A request for regrading of an altered exam is a serious violation of academic integrity (see below). Submission of a Lab Notebook or Lab Report with *any* form of data alteration or fabrication or copying of old reports is also regarded as a serious violation of academic integrity (see below).

Laboratory: The CHEM 300 laboratory, which meets four hours a week, is essential to the course. The laboratory grade counts for 45% of your grade in the course. The grade is based on lab pre-write-ups, lab reports, and your lab notebook. More detail about lab grading policy will be provided by the TA's.

To receive a passing grade in the course, passing work must be done in BOTH the lab and lecture parts.

You will need to keep a Lab Notebook. The Lab Notebook is an extremely important part of any laboratory since it is the permanent record of what was done and what was observed. Thus, you will be graded on the quality of maintenance of your Lab Notebook. Your Notebook must be examined by the TA and signed by him/her at the end of every lab session. It must have carbon pages and you must turn in the carbons *from every period* when you leave. More information on the laboratory work is included in the *Lab Manual* which you will receive at lab check-in, and you will learn about all policy issues at that time.

Safety is always the first priority in any laboratory. Your Teaching Assistants will fill you in on how to comply with the requirements for maintaining a safe environment and using safe laboratory techniques. Failure to comply with these procedures will result in a student's immediate expulsion from the laboratory.

The laboratory will comprise eight experiments counting 100 points each. This total will be normalized to count for 45% of your total course grade.

To receive a passing grade in the course, passing work must be done in BOTH the lab and lecture parts.

Policy on Dropping and Incompletes: Friday, November 12th is the last day to drop this course with a mark of W. University policy requires strict adherence to this deadline. The mark of "Incomplete" (IN) can be given *only* to a student who (1) is doing passing work as of Friday, November 12th and (2) is unable to complete the course because of serious illness or documented emergency occurring *after* that date.

Academic Integrity: It is always assumed that any work submitted for grading is an original and individual effort (except for group projects). Submission of any verbatim copied material (plagiarism) is a serious violation of academic integrity. A request for regrading of an altered exam is a very serious infraction. Submission of a Lab Notebook or Lab Report with "dry-lab" or other forms of data fabrication or copying of old reports is regarded as a serious violation of academic integrity.

Any incident of dishonesty in either the laboratory or lecture part of the course is required by the College to be reported to the office of Student Judicial Affairs and Community Standards (SJACS) and may result in a grade of F for the course. If previous reports of dishonesty exist, the student may be expelled from the University.

The Trojan Integrity Guide can be found at
<http://www.usc.edu/student-affairs/SJACS/forms/tio.pdf>.

The Undergraduate Guide for Avoiding Plagiarism can be found at
<http://www.usc.edu/student-affairs/SJACS/forms/tig.pdf>.

Students with Disabilities: Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m. – 5:00 p.m., Monday through Friday. The phone number for DSP is (213) 740-0776.

TENTATIVE LECTURE SCHEDULE

1 Monday	8/23	Chap. 0: Introduction
2 Wednesday	8/25	1 Measurements; 2 Tools
3 Friday	8/27	3 Error
4 Monday	8/30	4 Statistics
5 Wednesday	9/1	4
6 Friday	9/3	6 Equilibrium
Monday	9/6	<i>Labor Day - Holiday</i>
7 Wednesday	9/8	6
8 Friday	9/10	8 Activity and Systematic Equilibrium
9 Monday	9/13	8 <u>End of Exam 1 Material</u>
10 Wednesday	9/15	9 Monoprotic Acids
Friday	9/17	EXAM 1
11 Monday	9/20	9
12 Wednesday	9/22	10 Polyprotic Acids
13 Friday	9/24	11 Acid-Base Titrations
14 Monday	9/27	11
15 Wednesday	9/29	12 EDTA Titrations
16 Friday	10/1	12
17 Monday	10/4	18 Fundamentals of Spectroscopy
18 Wednesday	10/6	18
19 Friday	10/8	18
20 Monday	10/11	19 <u>Apps of Spectroscopy</u> <i>End of Exam 2 Material</i>
21 Wednesday	10/13	20 Spectrometers - Interferometry
Friday	10/15	EXAM 2
22 Monday	10/18	20
23 Wednesday	10/20	NMR Spectroscopy
24 Friday	10/22	NMR
25 Monday	10/25	NMR
26 Wednesday	10/27	21 Atomic Spectroscopy
27 Friday	10/29	21
28 Monday	11/1	23 Analytical Separations
29 Wednesday	11/3	23

30 Friday	11/5	24 <u>Gas Chromatography</u>	<u>End of Exam 3 Material</u>
31 Monday	11/8	25 HPLC	
Wednesday	11/10	EXAM 3	
32 Friday	11/12**	25	
33 Monday	11/15	26 Capillary Electrophoresis	
34 Wednesday	11/17	26	
35 Friday	11/19	14 Fundamentals of Electrochemistry	
36 Monday	11/22	14	
37 Wednesday	11/24	14	
Friday	11/26	Thanksgiving Break	
38 Monday	11/29	15 Electrodes and Potentiometry	
39 Wednesday	12/1	15	
40 Friday	12/3	15 (Last Class)	

Monday, December 13th

FINAL EXAM, 8:00-10:00

** Friday, November 12th is the last day to withdraw from the class with a mark of "W".

LABORATORY EXPERIMENTS

1. Determination of Na₂CO₃ with Standard HCl
2. Study of an Organic Acid
3. Optimization of GC Analysis: the van Deemter Plot
4. EDTA Titration of Ca²⁺ and Mg²⁺ in Natural Waters
5. Analysis of the Components in an Over-the-Counter Analgesic Drug using Ultraviolet Spectroscopy and HPLC
6. Determination of the *d*-Limonene Content in Orange Rind Using Gas Chromatography
7. Determination of Iron in a Vitamin Tablet by Two Methods: Atomic Absorption and Ultraviolet-Visible Spectroscopy
8. HPLC – To be announced

LABORATORY SCHEDULE

1	Monday	8/23	Check in		
	Thursday	8/26	Check-In		
2	Monday	8/30	1(a)		
	Thursday	9/2	1(a)		
	Monday	9/6	<i>Labor Day Holiday</i>		
	Thursday	9/9	<i>No Lab</i>		
3	Monday	9/13	1(b)		
	Thursday	9/16	1(b)		
4	Monday	9/20	2(a)		
	Thursday	9/23	2(a)		
5	Monday	9/27	2(b)		
	Thursday	9/30	2(b)		
6	Monday	10/4	2(c)		
	Thursday	10/7	2(c)		
			<u>Group A</u>	<u>Group B</u>	<u>Group C</u>
7	Monday	10/11	3	4	5
	Thursday	10/14	3	4	5
8	Monday	10/18	4	5	3
	Thursday	10/21	4	5	3
9	Monday	10/25	5	3	4
	Thursday	10/28	5	3	4
10	Monday	11/1	6	7	8
	Thursday	11/4	6	7	8
11	Monday	11/8	7	8	6
	Thursday	11/11	7	8	6
12	Monday	11/15	8	6	7
	Thursday	11/18	8	6	7
	Monday*	11/22	Check-Out		
	Thursday	11/25	<i>Thanksgiving recess-- No lab</i>		
	Monday*	11/29	Check-Out		
	Thursday*	12/2	Check-Out		

*Laboratory checkout on any one of the three designated days is mandatory. If you do not check out, a hold will be placed on your course grade until you do so at the convenience of the TA.

Laboratory Report DUE DATES

Monday	9/20	1		
Thursday	9/23	1		
Monday	10/11	2		
Thursday	10/14	2		
		<u>Group A</u>	<u>Group B</u>	<u>Group C</u>
Monday	10/18	3	4	5
Thursday	10/21	3	4	5
Monday	10/25	4	5	3
Thursday	10/28	4	5	3
Monday	11/1	5	3	4
Thursday	11/4	5	3	4
Monday	11/8	6	7	8
Thursday	11/11	6	7	8
Monday	11/15	7	8	6
Thursday	11/18	7	8	6
Monday	11/29	8	6	7
Thursday	12/2	8	6	7

Return Dates for Graded Laboratory Reports

Monday	9/27	1
Thursday	9/30	1
Monday	10/18	2
Thursday	10/21	2
Monday	11/8	3, 4, 5
Thursday	11/11	3, 4, 5
Returned at Final Exam		6, 7, 8