



Course	CHEM 2401 / Quantitative Chemical Analysis ("QCA")
Professor	Dr. Haines
Term	Spring 2007
Meetings	MW; 8:30 am –12:15 pm

Professor's Contact Information

Office Phone	972-883-4542
Office Location	Berkner Hall (BE) Room 2.518
Email Address	haines@utdallas.edu
Office Hours	Monday 12:00–1:00 pm
Other Information	<p style="text-align: center;"><u>Room / Times</u></p> CBW 1.103 08:30 - 09:45 a.m. BE 3.314 09:45 - 12:15 a.m. We will also use BE3.102, the laptop computer lab, for some lectures and data analysis. Dates and times will be announced. TAs: Mary Osasere and Eric Becraft

General Course Information

Pre-requisites, Co-requisites, & other restrictions	CHEM 1312 and 1112 (General Chemistry II Lecture and Lab).
Course Description	A study of the theory, applications, and calculations involved in the methods of analysis; theory and practice of volumetric, gravimetric, and spectrophotometric methods.
Learning Outcomes	<p><u>Objectives</u> This course emphasizes the theory, applications, and calculations involved in the methods of analysis; and the theory and practice of volumetric, gravimetric, and spectrophotometric methods of analysis.</p> <p><u>Expected Learning Outcomes</u> Students should be able to:</p> <ol style="list-style-type: none">1. Solve stoichiometric and other analytical calculations2. Demonstrate their ability to carry out quantitative volumetric, photometric, and potentiometric determinations3. Explain the necessity for and use of error estimates and statistical methods4. Master the use of spreadsheets like Excel5. Operate at a level of good laboratory practice including safety and cleanliness6. Implement a professional-level lab notebook7. Construct professional-level lab reports
Required Texts & Materials	"Quantitative Chemical Analysis, 7th ed." by Daniel C. Harris www.whfreeman.com/qca "Cold Springs Harbor Research Laboratory Notebook" This 8.5"x11" notebook was chosen since it has carbon-copy pages.
Supplemental Texts, Readings, & Materials	<ul style="list-style-type: none">• Students are financially responsible for any item checked out of the stockroom.• Other course materials may be recommended or required.• Gen Chem I and II TAs: visit BE 3.502 for a list of their office hours.• Tutors: See the Chem. Dept. AA (BE 2.312) for the updated list of tutors.• General Chemistry version 3.0 (interactive DVD-ROM covering one year of freshman general chemistry); available through CSA or at www.t2i2edu.com

Schedule & Academic Calendar

		Lecture	7th ed Chapter	6th ed Chapter	Lab	
M	1/8/2007					
W	1/10/2007	Introduction	0,1,2	0,1,2		
M	1/15/2007	HOLIDAY				
W	1/17/2007	Error and statistics	3,4	3,4		Safety and Check in
M	1/22/2007	Error and statistics	3,4	3,4	1	Calibration of Volumetric Glassware
W	1/24/2007	Calibration and Qual. Assur.	5	5 & 29	1	
M	1/29/2007	Equilibrium	6	6	5	Statistical Evaluation of Acid-Base Indicators
W	1/31/2007	Titrations	7	7	5	
M	2/5/2007	Activity	8	8	6	Preparing Standard Acid and Base
W	2/7/2007	Advanced equilibria	8	9	6	
M	2/12/2007	Acids and Bases	9	10	7	Using a pH electrode for an acid base titration
W	2/14/2007	Acids and Bases	10	11	7	
M	2/19/2007	Acids and Bases	11	12	8	Analysis of a mixture of carbonate and bicarbonate
W	2/21/2007	Acids and Bases	11	12	8	
M	2/26/2007	Exam 1			no lab	
W	2/28/2007	EDTA Titrations	12	13	no lab	
M	3/5/2007	SPRING BREAK				
W	3/7/2007	SPRING BREAK				
M	3/12/2007	Advanced Equilibria	13	-	11	EDTA Titration of Ca and Mg in natural waters
W	3/14/2007	Electrochemistry	14	14	11	
M	3/19/2007	Electrochemistry	15	15	15	Potentiometric Halide Titration with Ag ⁺
W	3/21/2007	Electrochemistry	16	16	15	
M	3/16/2007	Electrochemistry	17	17	19	Spectrophotometric Analysis of Iron in Vitamins
W	3/28/2007	Spectrophotometry	18	18	19	
M	4/2/2007	Spectrophotometry	19	19	22	Spectrophotometric Analysis of a Mixture (Caffeine Benzoic)
W	4/4/2007	Spectrophotometry	19	19	22	
M	4/9/2007	Analytical Separations	23	23	26	Properties of an Ion-Exchange Resin
W	4/11/2007	Analytical Separations	23	23	26	
M	4/16/2007	Final Exam (Exam 2)				Clean and Checkout
W	4/18/2007	Special Topics				
M	4/23/2007	Wrapup and Course Review				

Course Policies

	Harris Exp #	Title	PDF Page #
Experiments	1.	Calibration of Volumetric Glassware	2
	5.	Statistical Evaluation of Acid-Base Indicators	15
	6.	Preparing Standard Acids and Bases	18
	7.	Using a pH Electrode for an Acid-Base Titration	19
	8.	Analysis of a Mixture of Carbonate and Bicarbonate	22
	15.	Potentiometric Halide Titration with Ag ⁺	40
	11.	EDTA Titration of Ca ²⁺ and Mg ²⁺ in Natural Waters	29
	19.	Spectrophotometric Determination of Iron in Vitamin Tablets	48
	22.	Spectrophotometric Analysis of a Mixture: Caffeine & Benzoic Acid	54
	26.	Properties of an Ion-Exchange Resin	66
Safety	<p>IMPORTANT: In accordance with University and Chemistry Department safety rules, any time anyone (student, TA, instructor, or visitor) is in a lab, Z87-rated safety eyewear must be worn. The first violation in the semester will result in a warning and removal from the lab until the safety eyewear is in-place. The second violation in the semester will result in dismissal from that lab period with no extra time being allowed for make-up of the work scheduled for that lab period. Similar penalties will apply if any other safety rules are violated. In summary, all students are responsible for all information inside the undergraduate safety manual; it is located at: www.utdallas.edu/nsm/chemistry/resources/safety.html</p> <p>In addition, please refer to Dr.P.'s supplemental handout concerning optical and electrical safety issues.</p>		
Lab Reports	<p>Each student must prepare his or her own Lab Report for all 10 experiments based on the guidelines described in the Dr.P.'s Handout "Writing a Laboratory Report". The Lab Report for Exp. 1 will be evaluated but it will not count towards your grade. Each Lab Report will be worth 6 pts. Your 8 best Lab Reports will be summed for your Lab Report Score (48 pts. Total).</p> <p>Please refer to the Class Calendar for all Lab Report Due Dates. Lab Reports are due at the beginning of class. Late Lab Reports will be penalized at a deduction rate of 21% per week.</p> <p>Make-up of lab periods/experiments missed (for valid medical or emergency reasons) will be attempted based on the constraints of apparatus, BE 3.314, and professor/TA availability.</p>		
Lab NoteBooks	<p>Each student must bring his or her Lab NoteBook to Berkner every Monday and Wednesday. Each student must keep his or her own neat and orderly Lab NoteBook using ink. Please put your name and a date on every NoteBook page you use. In addition, be sure to include data labels and units on all tables and graphs. Drawing chemical structures and balanced chemical reactions in your NoteBook (and in your Lab Reports) is highly encouraged. Additional tips for keeping a professional NoteBook can be found on page 25 of your textbook. Your NoteBook must be signed and dated by your TA at the end of any day you spend working in the lab.</p>		
Lab Technique	<p>Each student will be evaluated with respect to their: adherence to good safety practices, laboratory technical skills, and laboratory etiquette/professionalism. The evaluations will be made by your TA (with the professor) at the end of each Experiment (10 pts. Total). If you do not attend, you can not earn Technique Points.</p>		
Quizzes	<p>There will not be make-up quizzes; a missed quiz equates to 0 pts. Quizzes may or may not be announced. Quizzes will be in class, take home, and/or on WebCT.</p>		
Midterm Exam	<p>The Midterm Exam* (Monday, February 26) will focus on Equilibrium, Acids and Bases, pH and pKa Calculations, Buffers, and Titration Curves. There will not be a make-up Midterm Exam; a missed Midterm Exam equates to 0 pts.</p>		
Final Exam	<p>The Final Exam* (Monday, April 16) is cumulative because "Knowledge in Chemistry is Cumulative" (Dr. Jung, UCLA, 1982). There will not be a make-up Final Exam; a missed Final Exam equates to 0 pts.</p>		

Grading (credit) Criteria	<p>Summary of Points:</p> <table style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: right;"><u>Pts.</u></th> </tr> </thead> <tbody> <tr> <td>Lab Reports & NoteBooks</td> <td style="text-align: right;">48</td> </tr> <tr> <td>Lab Technique</td> <td style="text-align: right;">10</td> </tr> <tr> <td>Quizzes</td> <td style="text-align: right;">6</td> </tr> <tr> <td>Midterm Exam</td> <td style="text-align: right;">12</td> </tr> <tr> <td>Cumulative Final</td> <td style="text-align: right;"><u>24</u></td> </tr> <tr> <td>Total</td> <td style="text-align: right;">100</td> </tr> </tbody> </table> <p>Your final letter grade for the course will be determined using a scale such as the one below where the class average is set at the "B-/C+" border (e.g., 79.5 points):</p> <table style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td>A+</td> <td>97 & above</td> <td>C</td> <td>73-76</td> </tr> <tr> <td>A</td> <td>93-96</td> <td>C-</td> <td>70-72</td> </tr> <tr> <td>A-</td> <td>90-92</td> <td>D+</td> <td>67-69</td> </tr> <tr> <td>B+</td> <td>87-89</td> <td>D</td> <td>63-66</td> </tr> <tr> <td>B</td> <td>83-86</td> <td>D-</td> <td>60-62</td> </tr> <tr> <td>B-</td> <td>80-82</td> <td>F</td> <td>59 & below</td> </tr> <tr> <td>C+</td> <td>77-79</td> <td></td> <td></td> </tr> </tbody> </table>		<u>Pts.</u>	Lab Reports & NoteBooks	48	Lab Technique	10	Quizzes	6	Midterm Exam	12	Cumulative Final	<u>24</u>	Total	100	A+	97 & above	C	73-76	A	93-96	C-	70-72	A-	90-92	D+	67-69	B+	87-89	D	63-66	B	83-86	D-	60-62	B-	80-82	F	59 & below	C+	77-79		
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Extra Credit	None																																										
Student Conduct and Discipline	<p>The University of Texas System and The University of Texas at Dallas have rules and regulations for the orderly and efficient conduct of their business. It is the responsibility of each student and each student organization to be knowledgeable about the rules and regulations which govern student conduct and activities. General information on student conduct and discipline is contained in the UTD publication, <i>A to Z Guide</i>, which is provided to all registered students each academic year.</p> <p>The University of Texas at Dallas administers student discipline within the procedures of recognized and established due process. Procedures are defined and described in the <i>Rules and Regulations, Board of Regents, The University of Texas System, Part 1, Chapter VI, Section 3</i>, and in Title V, Rules on Student Services and Activities of the university's <i>Handbook of Operating Procedures</i>. Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations (SU 1.602, 972/883-6391).</p> <p>A student at the university neither loses the rights nor escapes the responsibilities of citizenship. He or she is expected to obey federal, state, and local laws as well as the Regents' Rules, university regulations, and administrative rules. Students are subject to discipline for violating the standards of conduct whether such conduct takes place on or off campus, or whether civil or criminal penalties are also imposed for such conduct.</p>																																										
Academic Integrity	<p>The faculty expects from its students a high level of responsibility and academic honesty. Because the value of an academic degree depends upon the absolute integrity of the work done by the student for that degree, it is imperative that a student demonstrate a high standard of individual honor in his or her scholastic work.</p> <p>Scholastic dishonesty includes, but is not limited to, statements, acts or omissions related to applications for enrollment or the award of a degree, and/or the submission as one's own work or material that is not one's own. As a general rule, scholastic dishonesty involves one of the following acts: cheating, plagiarism, collusion and/or falsifying academic records. Students suspected of academic dishonesty are subject to disciplinary proceedings.</p>																																										

	<p>Plagiarism, especially from the web, from portions of papers for other classes, and from any other source is unacceptable and will be dealt with under the university's policy on plagiarism (see general catalog for details). This course will use the resources of turnitin.com, which searches the web for possible plagiarism and is over 90% effective.</p>
Email Use	<p>The University of Texas at Dallas recognizes the value and efficiency of communication between faculty/staff and students through electronic mail. At the same time, email raises some issues concerning security and the identity of each individual in an email exchange. The university encourages all official student email correspondence be sent only to a student's UTD email address and that faculty and staff consider email from students official only if it originates from a UTD student account. This allows the university to maintain a high degree of confidence in the identity of all individual corresponding and the security of the transmitted information. UTD furnishes each student with a free email account that is to be used in all communication with university personnel. The Department of Information Resources at UTD provides a method for students to have their UTD mail forwarded to other accounts.</p>
Withdrawal from Class	<p>The administration of this institution has set deadlines for withdrawal of any college-level courses. These dates and times are published in that semester's course catalog. Administration procedures must be followed. It is the student's responsibility to handle withdrawal requirements from any class. In other words, I cannot drop or withdraw any student. You must do the proper paperwork to ensure that you will not receive a final grade of "F" in a course if you choose not to attend the class once you are enrolled.</p>
Student Grievance Procedures	<p>Procedures for student grievances are found in Title V, Rules on Student Services and Activities, of the university's <i>Handbook of Operating Procedures</i>.</p> <p>In attempting to resolve any student grievance regarding grades, evaluations, or other fulfillments of academic responsibility, it is the obligation of the student first to make a serious effort to resolve the matter with the instructor, supervisor, administrator, or committee with whom the grievance originates (hereafter called "the respondent"). Individual faculty members retain primary responsibility for assigning grades and evaluations. If the matter cannot be resolved at that level, the grievance must be submitted in writing to the respondent with a copy of the respondent's School Dean. If the matter is not resolved by the written response provided by the respondent, the student may submit a written appeal to the School Dean. If the grievance is not resolved by the School Dean's decision, the student may make a written appeal to the Dean of Graduate or Undergraduate Education, and the dean will appoint and convene an Academic Appeals Panel. The decision of the Academic Appeals Panel is final. The results of the academic appeals process will be distributed to all involved parties.</p> <p>Copies of these rules and regulations are available to students in the Office of the Dean of Students, where staff members are available to assist students in interpreting the rules and regulations.</p>
Incomplete Grades	<p>As per university policy, incomplete grades will be granted only for work unavoidably missed at the semester's end and only if 70% of the course work has been completed. An incomplete grade must be resolved within eight (8) weeks from the first day of the subsequent long semester. If the required work to complete the course and to remove the incomplete grade is not submitted by the specified deadline, the incomplete grade is changed automatically to a grade of F.</p>
Disability Services	<p>The goal of Disability Services is to provide students with disabilities educational opportunities equal to those of their non-disabled peers. Disability Services is located in room 1.610 in the Student Union. Office hours are Monday, Thursday, 8:30 am to 6:30 pm; Tuesday, Wednesday, 8:30 am to 7:30 pm; & Friday, 8:30 am to 5:30 pm.</p> <p>The contact information for the Office of Disability Services is: The University of Texas at Dallas, SU 22 PO Box 830688 Richardson, Texas 75083-0688</p>

	<p>(972) 883-2098 (voice or TTY)</p> <p>Essentially, the law requires that colleges and universities make those reasonable adjustments necessary to eliminate discrimination on the basis of disability. For example, it may be necessary to remove classroom prohibitions against tape recorders or animals (in the case of dog guides) for students who are blind. Occasionally an assignment requirement may be substituted (for example, a research paper versus an oral presentation for a student who is hearing impaired). Classes enrolled students with mobility impairments may have to be rescheduled in accessible facilities. The college or university may need to provide special services such as registration, note-taking, or mobility assistance.</p> <p>It is the student's responsibility to notify his or her professors of the need for such an accommodation. Disability Services provides students with letters to present to faculty members to verify that the student has a disability and needs accommodations. Individuals requiring special accommodation should contact the professor after class or during office hours.</p>
<p>Religious Holy Days</p>	<p>The University of Texas at Dallas will excuse a student from class or other required activities for the travel to and observance of a religious holy day for a religion whose places of worship are exempt from property tax under Section 11.20, Tax Code, Texas Code Annotated.</p> <p>The student is encouraged to notify the instructor or activity sponsor as soon as possible regarding the absence, preferably in advance of the assignment. The student, so excused, will be allowed to take the exam or complete the assignment within a reasonable time after the absence: a period equal to the length of the absence, up to a maximum of one week. A student who notifies the instructor and completes any missed exam or assignment may not be penalized for the absence. A student who fails to complete the exam or assignment within the prescribed period may receive a failing grade for that exam or assignment.</p> <p>If a student or an instructor disagrees about the nature of the absence [i.e., for the purpose of observing a religious holy day] or if there is similar disagreement about whether the student has been given a reasonable time to complete any missed assignments or examinations, either the student or the instructor may request a ruling from the chief executive officer of the institution, or his or her designee. The chief executive officer or designee must take into account the legislative intent of TEC 51.911(b), and the student and instructor will abide by the decision of the chief executive officer or designee.</p>

These descriptions and timelines are subject to change at the discretion of the Professor.