

NOTE: Exam copies have been redacted from this report.

2011 Periodic Report Checklist ACS Committee on Professional Training

- Use the cover sheets from the website. Organize your report in the order of the cover sheets.
- Submit three copies of your periodic report form.
 - Submit two copies of your printed college catalog or two copies of the department and course description pages of your on-line catalog.
 - Refer to the ACS Guidelines for the requirements for an ACS-approved program.
 - Submit two copies of all course materials from five **in-depth** courses taught within the chemistry program that represent coverage in each of the five chemistry subdisciplines: analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, and physical chemistry (ABIOP).

Course materials must include:

- Syllabus with a list of topics taught (not references to book chapters or pages)
- All exams, including the final

Materials must be from courses taught during the last two academic years.

If you did not teach an in-depth course in a particular subdiscipline during the last two academic years, submit the materials for the foundation course instead.

- If the only coverage in a foundation area is provided by a course taught outside the chemistry department, submit two copies of the syllabi and exams for that course work as well as materials from five courses taught within the chemistry department.

Submit two copies of syllabi and exams for courses taught outside the chemistry program if they are used as one of the four (or six for programs on the quarter system) required in-depth courses used for student certification.

- Submit two copies of the experiment lists from courses used to cover at least four of the five foundation areas (ABIOP). Include a descriptive title and a list of instruments used in each experiment, if applicable. Include the course title and course number for each experiment list.
- Include the school name, course name, course number, and year taught on all course materials.**
- If research may be used to fulfill certification requirements, submit a sample (one copy of three to five reports) of the comprehensive student research reports or theses representative of multiple disciplines and faculty, with the grade the student received indicated on each report. Also indicate on each report the number of terms (semesters or quarters) and actual student hours per term of research covered by the report. The reports must be prepared by students. Do not submit publication reprints or co-authored reports. These reports will be returned if you so indicate on page 18, item 6.2 of the report form.

If your department does not have a full listing in the ACS Directory of Graduate Research,

- Submit two copies of a list of all faculty and student publications from the last five years. Please underline the names of undergraduate student authors where applicable.

Forms can be downloaded at:

URL: <http://acswebcontent.acs.org/cpt/>

Username: 75th

Password: anniversary

Submit your report to:

Office of Professional Training
American Chemical Society
1155 Sixteenth Street, N.W.
Washington, DC 20036

Sam Houston State University

Periodic Report

(Office of Professional Training's copy)

- Required
- All questions must be answered
- Stapled

2011 Periodic Report
to the
ACS Committee on Professional Training

Consult the ACS Guidelines (<http://www.acs.org/cpt>) before completing this report. The information contained in this report should pertain only to your undergraduate program. To facilitate committee review, all responses must be provided on this form. Extra pages for any of the tables are available on the website.

Name of Institution Sam Houston State University

City, State, and Zip Code Huntsville, TX 77341

Report Prepared by (e.g., Dr. Mary Smith or Juan Ruiz) Dr. Richard E. Norman

E-mail Address norman@shsu.edu

Phone Number (936) 294-1527

Current Chemistry Department Chair Name Richard E. Norman

Title Professor and Chair

Section 1

1.1 Degrees Offered in Chemistry (check those offered)

Bachelor's		<input checked="" type="checkbox"/>
Master's		<input checked="" type="checkbox"/>
Ph.D.		<input type="checkbox"/>

1.2 Number of Calendar Weeks per Term (not counting final exams)

Semester		<u>14</u>
Quarter		<u> </u>
4-1-4		<u> </u>
Other		<u> </u>

1.3 Provide the number of students in the current (most recently completed) academic year:

Entire Campus		<u>17291</u>
Undergraduates		<u>14689</u>
Chemistry Seniors		<u>61</u>
Sum of enrollments in all undergraduate chemistry courses		<u>2829</u>

1.4 Provide the number of bachelor's-degree graduates during the past five years who went on to:

Graduate School in the Chemical Sciences		<u>25</u>
Medical and other Professional Schools		<u>14</u>
Industry		<u>29</u>
Teaching		<u>2</u>
Other/Unknown		<u>41</u>

Section 2: Institutional Environment

2.1 Is the institution accredited by a regional accrediting association? Yes No
 Name of Accrediting Association Southern Association of Colleges and Schools

2.2 Is the chemistry department organized as an independent administrative unit? Yes No
 a. If no, how is the department or program administered and to whom does the department administrator report?

b. If no, who controls budgetary, personnel, and teaching decisions for the chemistry program and how are chemistry faculty involved?

2.3 a. Check the Minimum Salary for each Rank of Chemistry Faculty (Nine Months)

Minimum Salary	Professor	Associate Professor	Assistant Professor
Below \$51K	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
\$51 - \$60K	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
\$61 - \$70K	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
\$71 - \$80K	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
\$81 - \$90K	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Over \$90K	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2.4 Chemistry Expenditures (rough estimates - 2 significant figures):
 If your expenditures are over \$60,000 per year, excluding internal and external grants, salaries, and library budget, check here and go to item 2.5.

	Current	Annual Average Over the Past Five Years
Operating Expenditures Exclusive of Salaries	_____	_____
Instrument Maintenance and Repair	_____	_____
Student and Faculty Travel	_____	_____
Grants	_____	_____

2.5 Describe whether the level of institutional support allows the department to meet its teaching, infrastructure, and faculty development needs.
 Yes, except for the need of an additional faculty line.

Section 3: Faculty and Staff

3.1 Number of Chemistry Faculty in the Spring 2011 Academic Term (If you have no faculty in a particular category, record a "0".)

Faculty	Total Faculty	With Ph.D.	Male	Female	African American	Native American	Asian	Hispanic
Full-time total	9	9	8	1	0	0	0	0
Tenured	6	6	6	0	0	0	0	0
Pre-tenured	3	3	2	1	0	0	0	0
Long-term, non-tenure-track	0	0	0	0	0	0	0	0
Temporary	0	0	0	0	0	0	0	0
Part-time total	1	1	0	1	0	0	0	0
Tenured	0	0	0	0	0	0	0	0
Pre-tenured	0	0	0	0	0	0	0	0
Long-term, non-tenure-track	1	1	0	1	0	0	0	0
Temporary	0	0	0	0	0	0	0	0

3.2 Number of Instructional Staff (Do not include faculty listed in item 3.1 or teaching assistants. If you have no instructional staff in a particular category, record a "0".)

Instructional Staff	Total Staff	With Ph.D.	Male	Female	African American	Native American	Asian	Hispanic
Full-time	2	2	1	1	0	0	0	0
Part-time	1	1	0	1	0	0	1	0

3.3 Briefly describe your activities (especially successes) in expanding faculty diversity over the last five years. While we have attempted to expand faculty diversity over the past several years, we have actually become less diverse. In the spring of 2006, there were 11 instructional staff (one part time, one long term and the rest were tenured (6) or tenure track (3))--7 were male and 5 were female (including 2 who were tenured). Since then, both tenured females retired (one is now half-time), and two other females left. We hired an asian male (who moved to another program on campus) in the fall of 2006. Among our other hires, in every search there have been candidates other than white males, but ultimately the white males were the ones who were hired most frequently. For example, in our last hire, the finalists were an african female post-doc, a hispanic male post-doc and a white male who had been denied tenure (but was on the verge of success) who was hired due to his experience. Our part-time instructor also manages our stockroom and she is Sri Lankan.

While the numbers tabulated do not ask for this information, one of our hires was an eastern european female, which provides a different sort of diversity.

3.4 a. Number of Support Staff:

Secretarial	1
Stockroom	1
Instrument Technicians	_____
Other	_____

b. Comment on the adequacy of support staff.
 The stockroom staff listed above is also listed above as part-time instructional staff. Her position is new since our last 5-year report.

3.5 Describe the professional development opportunities (including sabbaticals) that are available to chemistry faculty and instructional staff.

Since our last 5-year report, two of the faculty have had sabbaticals (and they were the only two that applied). Most of the faculty have attended one or more professional meetings in the past year (and everyone who has asked for funding to attend a meeting has received it).

3.6 Report the number of chemistry faculty and instructional staff who have taken a sabbatical or professional leave in the last five years.

Requested	<u>2</u>
Granted	<u>2</u>

3.7 Teaching Contact Hours for 2010-2011 Academic Year (Classroom and Lab)

a. Contact Hours/week for Chemistry Faculty

Range from 3 to 11 ; Average 7

b. Contact Hours/week for Instructional Staff:

Range from 3 to 12 ; Average 8

c. Are maximum and/or minimum teaching loads established as an institutional policy?

Yes No

If yes, explain briefly:

New faculty hires have an expected teaching load of 9 hours, and some of the older tenured faculty have an expected teaching load of 12 hours. These hours are defined to be 1 hour for: (1) each lecture hour, (2) two hours of direct laboratory supervision, and (3) four hours of supervising a teaching-assistant-led laboratory. Typically our loads include supervising teaching-assistant-led laboratories (which decreases our average Contact Hour count).

d. Do contact hours include time spent supervising undergraduate research? Yes No

3.8 Do you use student teaching assistants? Yes No

If yes, describe the formal instruction in laboratory and/or classroom teaching provided to student teaching assistants.

Our student teaching assistants are not involved in classroom teaching, but they are the contact instructors in our teaching laboratories (faculty & instructional staff are the instructors of record). Our student teaching assistants receive several hours of informal instruction over the semester in the form of an initial TA meeting prior to the beginning of our laboratory courses, and weekly TA meetings with the instructors of record.

Table 3.1 – Teaching Contact Hours

Provide the teaching contact hours (actual hours per week) for each faculty member involved in undergraduate instruction for the 2010-2011 academic year. List one faculty member per row and enter as many faculty per page as possible. List non-tenure-track faculty, temporary faculty, and instructional staff last and **identify them with asterisks**. Do not include graduate teaching assistants. If the average teaching load for your department is less than 12 contact hours per week, only complete Table 3.1 for those individual faculty members with 12 or greater contact hours per week. Additional copies of this table are available at the periodic report website.

Faculty Member (list according to rank)	Fall Semester/1 st Quarter 2010			Spring Semester/2 nd Quarter 2011				
	Course Number and Title	1*	2*	3*	Course Number and Title	1*	2*	3*
Mouse, Minnie (Professor)	CHEM112-Gen Chem I CHEM357- O.Chem I CHEM358- O.Chem Lab (2 sections)	3 3 0	0 3 4	13	CHEM257- Analytical Chemistry CHEM360-O.Chem II	3 3	3 3	12
*Perkins, Samuel (Instructor)	CHM135-Inorganic and Environmental Chemistry Lecture (for non-science majors) [4 sections]	3 3 3 3	0 0 0 0	12	CHM135-Inorganic and Environmental Chemistry Lecture (for non-science majors) [4 sections]	3 3 3 3	0 0 0 0	12
*Rose, Melanie (Instructor)	CHM135-In.&Env.Chem CHM135-In.&Env.Chem CHM138-Gen.Chem.I	3 3 3	0 0 0	9	CHM135-In.&Env.Chem CHM136 -Intro.O.Chem&Biochm CHM138-Gen.Chem.I CHM138-Gen.Chem.I	3 3 3 3	0 0 0 0	12

Number of class hours scheduled per week.
 *2 Number of contact hours of lab per week.
 *3 Total of columns 1 and 2 for a grand total for each faculty member.

Table 3.1 – Teaching Contact Hours (continued)

Third Quarter 2011 (Do not report Summer hours.)				
Faculty Member (list according to rank)	Course Number and Title	1*	2*	3*

Number of class hours scheduled per week.
 *2 Number of contact hours of lab per week.
 *3 Total of columns 1 and 2 for a grand total for each faculty member.

Section 4: Infrastructure

- 4.1 Comment on the adequacy and condition of your department's instruments and lab apparatus.
While some of our equipment is old, we have maintained it so it is functional and adequate for our purposes. In some cases, older pieces of equipment have failed, and have been replaced and systems have been upgraded.

In addition to the items listed, we also have access to other instrumentation on campus through the Texas Research Institute for Environmental Studies, the Department of Biology, the Department of Physics and the Forensic Science Master's Program (run through the College of Criminal Justice).

- 4.2 Comment on the adequacy of the facilities and space available for the undergraduate chemistry program.

With the growth in enrollment, we are feeling somewhat crowded, but the facilities and space are still adequate. Since our last 5-year report, we moved into a new building, and even in our new facility we are starting to feel a bit crowded.

- 4.3 a. Indicate the number of chemistry journals to which students have access on your campus. **If students have access to 30 or fewer chemistry journals, complete Table 4.2.**
- 30 or fewer More than 30
- b. What types of access do undergraduate students and faculty have to *Chemical Abstracts*? (Check all that apply.)
- Online through SciFinder Scholar
Online through STN
Other access
Specify
- c. If SciFinder Scholar is not among the ways your students access *Chemical Abstracts*, report the number of searches or the expenditure for searches of *Chemical Abstracts* per year.
- d. Describe briefly how undergraduate students and faculty access titles and abstracts on a regular basis (offices, library, PC, other).
computer access through offices, laboratories and personal machines

- 4.4 What is the maximum number of students in a laboratory who are directly supervised per faculty member, instructional staff member, or teaching assistant? 32

Table 4.1 Instrumentation and Specialized Laboratory Apparatus

If you have more than one of a particular instrument, please list it in the space directly under the first.

Only report functional instrumentation that is used by undergraduate students.

Instrument/Apparatus	Used by Undergraduates		Year Acquired	Manufacturer and Model
	In Chemistry Course Work	In Research		
NMR spectrometer(s)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1997	JEOL Eclipse+ 300
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2002	Anasazi Eft-60
UV-VIS spectrometer(s)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1994	Jasco V-550
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2003	Cary 50 Bio
Gas chromatograph(s)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1998	HP 6890
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2008	Agilent 7890A
Liquid chromatograph(s)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1999	Dynamax
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2004	Polaris Isocratic LC
IR spectrometer(s)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2003	ThermoNicolet IR 200
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1996	Matson ATI Infinity
Mass spectrometer(s)	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>		
Radiochemistry (including counting equipment and	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>		
Atomic absorption/emission	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1999	Varian Spectra 220/FS
	<input type="checkbox"/>	<input type="checkbox"/>		
Thermal analysis equipment	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2009	MettlerToledo DSC
	<input type="checkbox"/>	<input type="checkbox"/>		
Electrophoresis	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2002	FisherBiotech FB200
	<input type="checkbox"/>	<input type="checkbox"/>		FB-VE 10-1
Electrochemical instrumentation	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>		
GC-mass spectrometer(s)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	1995	Varian Saturn 2000
	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2010	Agilent 5975C 7890A
Schlenklines and dry box apparatus	<input type="checkbox"/>	<input checked="" type="checkbox"/>	var.	Home assembled
	<input type="checkbox"/>	<input type="checkbox"/>		
Imaging microscopy	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2006	Vertex 70 System
	<input type="checkbox"/>	<input type="checkbox"/>		
Additional Instruments (over \$10,000 in cost):				
Capillary Electrophoresis	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2002	BeckmanCoulter P/ACE
Fluorescence Spectrometer	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1995	Hitachi F-4500
Centrifuge	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2008	Eppendorf 5810R
Ion Chromatography	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2007	Dionex ICS-1500
Bioreactor/Fermentor-NewBrunswick Scientific	<input type="checkbox"/>	<input checked="" type="checkbox"/>	1996	BioFLO III
Raman Spectrometer	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2005	Raman Systems R-3000
Computational Cluster (dual quad core)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	2007	
Laser system	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2010	Omicron Ldm 785 nm
Autoclave	<input type="checkbox"/>	<input checked="" type="checkbox"/>	2005	Steris Amsco Lab 250
	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>		
	<input type="checkbox"/>	<input type="checkbox"/>		

Table 4.2 – Journal List (More than 30).

Indicate the current periodicals to which students have print or online access.

Journal

Accounts of Chemical Research

Advanced Functional Materials

Advanced Materials

Advanced Synthesis and Catalysis

Advances in Heterocyclic Chemistry

Advances in Protein Chemistry

Analyst

Analytical and Bioanalytical Chemistry

Analytical Biochemistry

Analytical Chemistry

Angewandte Chemie International Edition

Applied Catalysis A: General

Applied Spectroscopy

Biochemical Journal

Biochemistry

Bioconjugate Chemistry

Biomacromolecules

Bioorganic Chemistry

Catalysis Reviews: Science and Engineering

Chemical Biology (ACS)

Chemical Communications

The Chemical Educator

Chemical Physics Letters

Chemical Reviews

Chemical Society Reviews

Chemistry-A European Journal

Chemistry Education: Research and Practice

Chemistry Letters

Chemistry of Materials

Combinatorial Chemistry and High Throughput Screening

Coordination Chemistry Reviews

Critical Reviews in Biochemistry and Molecular Biology

Current Opinion in Chemical Biology

Current Organic Chemistry

Dalton Transactions

Electroanalysis

Electrophoresis

Environmental Science and Technology

European Journal of Inorganic Chemistry

European Journal of Organic Chemistry

FEBS Journal

Green Chemistry

Inorganic Chemistry

Journal of the American Chemical Society

Journal

Journal of the American Society for Mass Spectrometry

Journal of Applied Polymer Science

Journal of Biological Chemistry

Journal of Biological Inorganic Chemistry

Journal of Catalysis

Journal of Chemical Ecology

Journal of Chemical Education

Journal of Chemical Information and Modeling

The Journal of Chemical Physics

Journal of Chemical Theory and Computation

Journal of Chromatography A

Journal of Chromatography B

Journal of Combinatorial Chemistry

Journal of Medicinal Chemistry

Journal of Molecular Biology

The Journal of Organic Chemistry

Journal of Organometallic Chemistry

Journal of Physical Chemistry A

Journal of Physical Chemistry B

Journal of Physical Chemistry C

Journal of Polymer Science Part A: Polymer Chemistry

Journal of Proteome Research

Langmuir

Macromolecular Chemistry and Physics

Macromolecules

Molecular Cell

Nano Letters

Nature

Nature Chemical Biology

Nature Structural and Molecular Biology

New Journal of Chemistry

Organic and Biomolecular Chemistry

Organic Letters

Organometallics

Physical Chemistry Chemical Physics

Polymer

Proceedings of the National Academy of Science of the USA

Science

Supramolecular Chemistry

Synlett

Synthesis

Tetrahedron

Tetrahedron Letters

Trends in Biochemical Science

4.5 a. Are the following laboratory facilities **adequate** for your instructional program?

Safety showers Yes No Hoods Yes No
Eye washes Yes No Ventilation Yes No
Fire extinguishers Yes No

b. If no is checked for any item above, please explain.

		Yes	No
4.6 a.	Does the department/university have established safety rules?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Does the department/university have emergency reporting procedures?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Does your department have a written chemical hygiene plan?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Are there adequate facilities and arrangements for disposal of chemical waste?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Are safety information and reference materials (e.g., MSDS) readily available to all students and faculty?	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	Is personal protective equipment available and used by all students and faculty?	<input checked="" type="checkbox"/>	<input type="checkbox"/>

b. If no is checked for any of the above, please explain.

Section 5: Curriculum

5.1 a. Are all foundation courses taught annually? Yes No

b. If no is checked above, indicate the foundation courses that are **not** taught annually.

c. Are at least four semester-long (or six quarter-long) in-depth courses taught annually, exclusive of research? Yes No

d. If **a** or **c** above is checked no, describe how students can complete the requirements for a certified chemistry degree within four years.

5.2 Refer to section 5.6 of the ACS Guidelines for the definition of degree tracks and list only those degree tracks that lead to an ACS-certified bachelor's degree in chemistry or related field.

Track 1	Major in Chemistry for Professional Chemists
Track 2	
Track 3	
Track 4	
Track 5	
Track 6	
Track 7	

Complete Tables 5.1 – 5.4 only for those courses in degree tracks that may lead to an ACS-certified bachelor's degree.

Table 5.1 – Introductory Course Work

List all introductory chemistry course work students may use to prepare for the foundation course work listed in Table 5.2. Do not include courses listed in Tables 5.2 and 5.3 or courses that are not used for ACS certification purposes. Enter only one course per row.

Dept. & Course Number	Course Title	Total Hours ¹		Textbook and Author	Credit Hours	Tracks ²										
		Class	Lab			1	2	3	4	5	6	7				
CHM 138	General Chemistry I: Lecture	45	0	Chemistry: The Central Science 11 th Edition, Theodore L. Brown, H. Eugene LeMay, Jr., Bruce E. Bursten & Catherine J. Murphy	3	R										
CHM 118	General Chemistry I: Laboratory	0	39	General Chemistry I Laboratory Manual, Students and Staff at Sam Houston State University	1	R										
CHM 139	General Chemistry II: Lecture	45	0	Chemistry: The Central Science 11 th Edition, Theodore L. Brown, H. Eugene LeMay, Jr., Bruce E. Bursten & Catherine J. Murphy	3	R										
CHM 119	General Chemistry II: Laboratory	0	36	General Chemistry II Laboratory Manual, The Faculty, Students and Staff, Department of Chemistry, Sam Houston State University	1	R										

1. Total Hours refers to the total contact hours per term. Do not record credit hours or contact hours per week in this column.
2. Using the drop-down menu, indicate whether a course is required (R) or one of two or more alternatives (A) that students may choose for each degree track.

Table 5.2 – Foundation Course Work

List below all course work students may use to satisfy the FOUNDATION requirements in the sequence suggested for ACS certification. Do not include courses listed in Tables 5.1 and 5.3 or courses that are not used for ACS certification purposes. Refer to Section 5.3 of the ACS Guidelines for the definition of a foundation course. Enter only one course per row.

Dept. & Course Number	Course Title	Total Hours ¹		Textbook and Author	C	Subdisciplinary % Breakdown ³					Tracks ⁴								
		Class	Lab			A	B	I	O	P	1	2	3	4	5	6	7		
CHM 238	Organic Chemistry I: Lecture	45	0	Organic Chemistry, 7 th Edition, L. G. Wade, Jr.	3				100					R					
CHM 218	Organic Chemistry I: Laboratory	10	30	Chemistry 218 Laboratory Experiments, Compiled by Dr. Benny E. Arney, Jr.	1				100					R					
CHM 241	Quantitative Analysis	45	40	Quantitative Chemical Analysis, 7 th Edition, Daniel C. Harris	4	100								R					
CHM 348	Introductory Biochemistry	47	56	Biochemistry, 6 th Edition, Jeremy M. Berg, John L. Tymoczko & Lubert Stryer	4		100							R					
CHM 448	Physical Chemistry I	45	40	Physical Chemistry, 2 nd Edition, Thomas Engel & Philip Reid	4								100	R					
CHM 467	Advanced Inorganic Chemistry	47	0	Inorganic Chemistry, 3 rd or 4 th Edition, Gary L. Miessler & Donald A. Tarr	3				100					R					

1. Total hours refers to the total contact hours per term including the final. Do not record credit hours or contact hours per week in this column.

2. Indicate the credit hours (CH) for each course listed.

3. State the approximate percentage of each subdiscipline found in each course (analytical chemistry (A), biochemistry (B), inorganic chemistry (I), organic chemistry (O), and physical chemistry (P)). The percentage coverage must add up to 100% for each course. For example, Biophysics I might be 40% biochemistry and 60% physical or Organic Chemistry I might be 100% organic.

4. Using the drop-down menu, indicate whether a course is required (R) or one of two or more alternatives (A) that students may choose to meet the foundation requirements for each degree track.

Table 5.3 – In-Depth Course Work

List the **in-depth** course work used for ACS certification. Do not include courses listed previously in Tables 5.1 and 5.2. Refer to Section 5.4 of the ACS Guidelines for the definition of an in-depth course. Enter only one course per row.

Dept. & Course Number	Course Title	Total Hours ¹		Textbook and Author	Foundation Pre-Requisite Course #	C/O	Tracks ³								
		Class	Lab				1	2	3	4	5	6	7		
CHM 239	Organic Chemistry II: Lecture	45	0	Organic Chemistry, 7th Edition, L. G. Wade, Jr.	CHM 238	3	R								
CHM 219	Organic Chemistry II: Laboratory	10	30	Chemistry 219 Organic Chemistry Laboratory Manual, Chemistry Department, Sam Houston State University	CHM 238 & CHM 218	1	R								
CHM 449	Physical Chemistry II	45	40	Physical Chemistry, 2nd Edition, Thomas Engel & Philip Reid	CHM 448	4	R								
CHM 440	Instrumental Analytical Chemistry	47	44	Principles of Instrumental Analysis, 6 th Edition, Douglas A. Skoog, James Holler & Stanley R. Crouch	CHM 241	4	R								
CHM 426	Advanced Integrated Laboratory	14	98	Various	CHM 239, CHM 241, CHM 448	2	R								
CHM 339	Metabolism	47	0	Biochemistry, 6th Edition, Jeremy M. Berg, John L. Tymoczko & Lubert Stryer	CHM 348	3	E								
CHM 368	Environmental Chemistry	47	0	Environmental Chemistry, 4 th Edition, Colin Baird & Michael Cann	CHM 238, CHM 239, CHM 241	3	E								
CHM 442	Air Quality	47	52	Atmospheric Pollution, Mark Z. Jacobson	CHM 238, CHM 239, CHM 241	4	E								
CHM 443	Structural Spectroscopic Methods	45	52	Spectrometric Identification of Organic Compounds, 7 th Edition, Robert M. Silverstein, Francis X. Webster & David Kiemle	CHM 238, CHM 239	4	E								

CHM 480	Forensic Chemistry	47	0	Forensic Chemistry, 1 st Edition, Suzanne Bell	CHM 239, CHM 440, CHM 467(c)	3	E	--	--	--	--
								--	--	--	--

1. Total hours refers to the total contact hours per term including the final. Do not record credit hours or contact hours per week in this column.
2. Indicate the credit hours (CH) for each course listed.
3. Indicate whether a course is required (R) or elective (E) for each track using the drop-down menu.

Table 5.3 – In-Dep. Course Work (continued)

Dept. & Course Number	Course Title	Total Hours ¹		Textbook and Author	Foundation Pre-Requisite Course #	CH	Tracks ³											
		Class	Lab				1	2	3	4	5	6	7					

1. Total hours refers to the total contact hours per term including the final. Do not record credit hours or contact hours per week in this column.
 2. Indicate the credit hours (CH) for each course listed.
 3. Indicate whether a course is required (R) or elective (E) for each track using the drop-down menu.

Table 5.4 – Physics and Mathematics Courses

List the physics and mathematics course work required for ACS certification. Refer to Section 5.7 of the ACS Guidelines. Enter only one course per row.

Dept. & Course Number	Course Title	Total Hours ¹		Department	Credit Hours	Tracks ²								
		Class	Lab			1	2	3	4	5	6	7		
PHY 138	General Physics Mechanics and Heat	45	0	Department of Physics	3	R	-	-	-	-	-	-	-	-
PHY 118	General Physics Laboratory I	0	28	Department of Physics	1	R	-	-	-	-	-	-	-	-
PHY 139	General Physics Sound, Light, Electricity and Magnetism	45	0	Department of Physics	3	R	-	-	-	-	-	-	-	-
PHY 119	General Physics Laboratory II	0	28	Department of Physics	1	R	-	-	-	-	-	-	-	-
MTH 142	Calculus I	73	0	Department of Mathematics and Statistics	4	R	-	-	-	-	-	-	-	-
MTH 143	Calculus II	73	0	Department of Mathematics and Statistics	4	R	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-
						-	-	-	-	-	-	-	-	-

1. Total hours refers to the total contact hours per term including the final. Do not record credit hours or contact hours per week in this column.
 2. Indicate whether a course is required (R) or elective (E) for each track using the drop-down menu.

5.4 How do your ACS-certified graduates in each degree track meet the in-depth course requirements?

List the names and course numbers. If a course is listed here, ensure it is also entered in Table 5.3.

We have a single ACS-certified track. In this track, all students are required to take CHM 239 & 219 (Organic Chemistry II: Lecture and Laboratory), CHM 449 (Physical Chemistry II), and CHM 440 (Instrumental Analytical Chemistry). The first two of these courses are the second semester of a two semester sequence in the discipline, and CHM 440 is the second required course in analytical chemistry. We also require students to take CHM 426 (Advanced Integrated Laboratory) which is primarily a laboratory course, and to take an advanced (300 & 400-level) elective in chemistry. These courses are listed above in Table 5.3: CHM 339, Metabolism (the second course in a two semester biochemistry sequence, offered annually); CHM 368, Environmental Chemistry and CHM 442, Air Quality (courses offered in alternate spring semesters); CHM 443, Structural Spectroscopic Methods (course offered every two years), and CHM 480, Forensic Chemistry (course offered annually).

In our course sequences, a grade of C or better is required in courses which are prerequisite courses, and the sequences build upon one another. Thus, the prerequisites for CHM 440 are de facto: CHM 138/118, CHM 139/119, CHM 238/218, CHM 239/219, CHM 241, PHY 138/118, PHY 139/119, MTH 142, MTH 143, and CHM 448.

How do ACS-certified graduates in each degree track meet the laboratory requirement of 400 hours. Include the subdisciplinary area (ABIOP) covered by each course and the number of lab hours devoted to each area. Do not include lab hours from general or introductory lab courses. If a course is listed here, ensure it is also entered in Table 5.2 or 5.3.

CHM 218 (O), 40 hrs
CHM 219 (O), 40 hrs
CHM 241 (A), 40 hrs
CHM 440 (A), 44 hrs
CHM 348 (B), 56 hrs
CHM 448 (P), 40 hrs
CHM 449 (P), 40 hrs
CHM 426 (I,O,P,A), 112 hrs
Total = 412 hrs

Additionally, two of the in-depth electives have laboratories associated with them, and all ACS-certified graduates are required to do one semester of undergraduate research.

5.6 Describe the computational chemistry facilities and software (e.g., Gaussian) that students use in their course work and research.

The department has a computational lab that houses two computational servers (dual quad core with 32 GB RAM) loaded with Gaussian 03 and 10 PC work stations. Various computer labs across campus are also used which have Microsoft Word, Excel, and various chemical drawing programs (like SymyxDraw and ChemDraw). Computers are also available in all of our research labs.

Of course, there are computers interfaced to virtually every instrument and specific software for those instruments.

5.7 How do students gain hands-on experience using chemical instrumentation?

Students gain hands-on experience with instrumentation in their required laboratory courses (beginning with CHM 219, Organic Chemistry II Laboratory, and continuing in CHM 241, Quantitative Analysis, CHM 348, Introductory Biochemistry, CHM 448, Physical Chemistry I, CHM 449, Physical Chemistry II, CHM 440, Instrumental Analytical Chemistry, and CHM 426, Advanced Integrated Laboratory), in their undergraduate research experience, and possibly in the advanced elective (if they choose CHM 442, Air Quality, or CHM 443, Structural Spectroscopic Methods).

Section 6: Undergraduate Research

6.1 Undergraduate Research

a. Do you use undergraduate research to fulfill certification requirements for lab hours?

Yes No

b. Do you use undergraduate research to fulfill certification requirements for in-depth course work?

Yes No

If yes to either question above, is a comprehensive written report required? Yes No

If no, go to item 6.3.

6.2 Submit a sample of the comprehensive student research reports or theses representative of multiple disciplines and faculty, with the grade the student received indicated on each report. Also indicate on each report the number of terms (semesters or quarters) and actual student hours per term of research covered by the report.

Number submitted _____ (5 maximum)

Should we return these reports? Yes No

6.3 Report on the participation in undergraduate research during the last five years.

a. Number of undergraduate majors (all degrees offered by your program) who participated in a research experience

175

b. Number of chemistry faculty who were regularly involved in research with undergraduates

all 9

6.4 If undergraduate research done outside of your institution is used to satisfy certification requirements, are students required to submit a comprehensive written research report that a faculty member at your institution evaluates and approves?

Yes No Not applicable

Section 7: Student Skills

- 7.1 Describe the experiences that develop student professional skills in problem-solving, communication, teamwork, and ethics (responsible scientific conduct). How are these skills assessed?**
These experiences include a couple of specific courses (CHM 426, Advanced Integrated Laboratory (typically taken in the last semester) and CHM 410, Chemical Literature Seminar (typically taken in the senior year)), several prerequisite courses that lead into the senior year, and in undergraduate research. For example, problem solving in various forms and varying levels of complexity is addressed from the very beginning in the first general chemistry course, and is subsequently addressed throughout the curriculum. Teamwork skills are initiated with lab partners in general chemistry labs, reinforced with some group work in analytical labs and biochemistry labs, and further strengthened in research group activity. Communication skills are developed throughout the curriculum as well, with particular emphasis on written communication in junior and senior lab courses (that require extensive lab reports), and in verbal communication in seminar. Ethics is addressed in various courses and again discussed in detail in the context of undergraduate research. The skills are assessed in various ways in the various courses as part of the grading process for the courses.
- 7.2 Describe how your students gain experience with the effective retrieval and use of chemical literature. How are these skills assessed?**
The use of the chemical literature is addressed most strongly in CHM 410, Chemical Literature Seminar, in writing various junior and senior level papers, and in undergraduate research. The syllabus for the seminar course (which is taught in both the fall and spring semesters) is included at the end of the syllabi. Included in the syllabus is the evaluation sheet used by all of the students enrolled in the course to evaluate their colleagues' presentations.
- 7.3 Describe how your program conveys safe lab practices to students. How are these skills assessed?**
Safe lab practices are conveyed to students in a variety of settings--presentation of safety rules and procedures in lab classes, discussion of safety rules and procedures in lab classes, demonstration of safety rules and procedures in lab classes, and enforcement of safety rules and procedures in lab classes.
- The "lab classes" refers to general chemistry I lab, general chemistry II lab, organic chemistry I lab, organic chemistry II lab, quantitative analysis lab, introductory biochemistry lab, physical chemistry I lab, physical chemistry II lab, instrumental analytical chemistry lab, advanced integrated lab and the elective lab courses.
- Safe lab practices are also demonstrated to students in undergraduate research settings. This latter setting also provides an opportunity to work one-on-one with the student to help them master particular skills.

Section 8: Program Self-Evaluation

8.1 Describe the program self-evaluation activities that your department has undertaken over the past five years. The submission of our last 5-year report nearly coincided with my arrival as the new chair of the department. Since my arrival, the department has had extensive discussion (self-evaluation) of most aspects of the department and its mission. We also moved into a new facility during this period, which helped us to focus on our infrastructure needs. Lastly, as part of the SACS reaffirmation process, and to remain in good standing with SACS, we undergo annual self-evaluation and assessment.

Specifically, we have reviewed our instrument holdings (and discarded those items that could no longer be made functional and items that were no longer used), we reconfigured our use of teaching laboratory space (and since the original reconfiguration, we have reconfigured twice more on a smaller scale), we reconsidered all of our course prerequisites and hardwired them into our system, we reorganized our general chemistry sequence and have discussed our overall curriculum numerous times.

Many of our overall curricular discussions and considerations have been a result of a significant change imposed on our program from outside--a state mandated reduction in credit hours required for the degree from 128 to 120, and a state mandated reduction in credit hours required for our forensic chemistry degree from 130 to 128. These mandated reductions occurred at a time when we had planned on increasing the number of credit hours required for the major, and when we were considering a track with no minor (that would allow an increase in the chemistry and math content). However, the local political climate precluded these changes.

Describe how the results of your department's self-evaluations have been used to improve student learning, student skills, and the effectiveness of the chemistry program.

As a result of the new enforced prerequisite structure, students were better prepared for their courses and course performance improved. Unfortunately, shortly thereafter, the University moved the drop date from the middle of the term to the end of the term and this resulted in greater numbers of D's and F's in courses.

As a result of our more conscious SACS-mandated annual assessment, we have paid more attention to certain details in student learning outcomes and we have made changes in our courses to address deficiencies that had not been previously readily apparent. For one example, as a result of the detailed assessment in physical chemistry, an additional week of coverage is being devoted to molecular orbital theory. For a second example, as a result of detailed assessment in organic chemistry, the instructors realized that the textbook that they had been using had been skipping steps in mechanisms (lowering student performance in this area), so a new textbook was selected this past year (and student performance has improved in this area).

Final Comments

Please comment on (in as much detail as you wish) changes in the last five years in faculty, diversity initiatives, professional development, support personnel, facilities, capital equipment, curriculum, and any other items related to your program that you believe would be of interest to CPT. We are especially interested in any new programs you are about to undertake. Use additional sheets, if necessary. Please do not include actual self-evaluation documents or reports.

As mentioned previously, since our last 5-year report, we moved into a new facility. In the Fall semester 2004 before we began to move into the new building, the total University enrollment was 14,371 and the number of students enrolled in chemistry courses was 1,866. In the Fall semester 2006 after had moved into the building, the total enrollment was 15,935 and our enrollment was 2,389. This past Fall semester (2010), the total enrollment was 17,291 and our enrollment was 2,829--since pre-move, the University has grown by 20% and chemistry enrollment has grown by 52%! While I don't have the figures for majors in 2004, in the Fall of 2005 we had 217 majors and in the Fall 2010, we had 291 majors, an increase of 34%.

While we have not yet outgrown our new building, we are starting to feel the pinch. For example, in the Fall 2005 semester, we had 2 sections (14 students total) of CHM 241 (Quant.) lab, 2 sections (43 students) of CHM 348 (Biochem) lab, and one section (15 students) of CHM 448 (P.Chem.) lab. In the Fall 2010, we had 3 sections (44 students) of 241, 3 sections (68 students) of 348, and 2 sections (35 students) of 448.

This growth has restricted some of what we might like to do. Another program modification that we have considered is the addition of a major in biochemistry. We anticipate that this addition would result in an increase in enrollment, and since we cannot accommodate a significant increase, we have not added the major.

One last area that should be addressed is our coverage of inorganic chemistry (as an inorganic chemist myself, this is a subject near and dear to me). Using the current ACS guidelines we may appear to be weak in inorganic because (1) we cannot use our general chemistry course as a foundation course (or even as part of a foundation course) since there is a prohibition specifically against general chemistry textbooks; (2) we are obligated to use our senior spring semester inorganic course (CHM 467, Advanced Inorganic Chemistry) as a foundation course rather than an in-depth course because this course does not have another inorganic course (since general chemistry does not count) as a prerequisite; (3) we cannot really mention another elective inorganic course that is offered (CHM 367, Introductory Inorganic Chemistry) as an in-depth course because it does not have CHM 467 as a prerequisite, and (4) we cannot really fully address the inorganic content in other courses, such as CHM 368, Environmental Chemistry, as contributing to our in-depth coverage since these courses do not have CHM 467 as a prerequisite. We are currently limited in the number of hours that we can require for a degree (to 120 semester credit hours) so to add, for example, CHM 367 as a foundation course prerequisite for the in-depth CHM 467, would require us to cut another 3 credit course from the curriculum. I am hopeful that the political climate will change so we can address this in the next several years.

One final comment--at the end of the spring 2011 semester and with the beginning of the summer 2011 semester, all of Sam Houston State University's course numbers have changed, so both numbers are listed in our catalog copy.

Current College Catalog

(Primary reviewer's copy)

Must include:

- Chemistry department description
- Degree requirements
- Course descriptions

OR

- Send one copy of your printed catalog and discard this cover sheet

Department of Chemistry

[Catalogs](#) > [Undergraduate Catalog 2010-2012](#) > [College of Arts & Sciences](#) > Department of Chemistry

The Department of Chemistry is approved by the American Chemical Society.

Chair: Richard (Rick) E. Norman (936) 294-1527 norman@shsu.edu

Faculty: [Benny Arney](#), [Tom Chasteen](#), [Mary Lynn DeShazo](#), [Donovan Haines](#), [Paul Loeffler](#), [Rick Norman](#), [Ilona Petrikovics](#), [David Thompson](#), [Rick White](#), [Darren Williams](#)

Website: www.shsu.edu/~chemistry/

Mission

The Department of Chemistry is committed to providing an educational environment conducive to scholarship, intellectual development, and the acquisition of a foundation of knowledge and techniques required of professional chemists. This goal requires the effective representation of the fundamental areas of chemistry, a dedicated and creative faculty, and support for the many functions of the department.

Academic Programs

- BS in Chemistry for professional chemists
- BS in Chemistry for other technical careers
- BS in Chemistry with emphasis in Biochemistry-Biotechnology
- BS in Chemistry with emphasis in Forensic Science
- BS in Forensic Chemistry
- BS in Composite Science with emphasis in Chemistry (program being phased out)
- BS in Chemistry/Chemical Engineering

The Department of Chemistry is approved by the American Chemical Society. Chemistry majors may pursue the Bachelor of Science for professional chemists that leads to American Chemical Society certification and prepares students for graduate studies in traditional chemical fields. Students interested in professional schools, chemistry associated industries, or secondary education may pursue the Bachelor of Science for other technical careers. The Bachelor of Science in Chemistry with emphasis in Biochemistry-Biotechnology prepares students for careers in hi-tech companies in the Houston area and across the state and nation. The growing interest in Forensic Science has prompted the Department of Chemistry to offer a Bachelor of Science in Forensic Chemistry that is designed to prepare students for

careers combining a knowledge of chemistry and the legal system. Students completing this degree can pursue opportunities in various forensic labs across the country, or can continue their education either in the graduate program in Forensic Science, or in graduate programs that are more traditional.

Highlights

- The Department of Chemistry has a study abroad program in Germany in which students carry out summer undergraduate research in a German University and can experience the culture and approach to chemical education in Europe.
- The Department of Chemistry moved into an impressive new facility (the Chemistry/ Forensic Science Building) during the Fall semester of 2005 greatly expanding and improving the laboratory facilities.

Career Opportunities

Everything around you is composed of chemicals. We live in a world of chemicals and life would not be possible without them. An understanding of the fundamentals of chemistry is important for everyone in today's society. Professional chemists are working to enhance our quality of life by improvements in food, medicine, clothing, building supplies, products for recreation, and a whole range of consumer products.

Virtually every industry or business that makes or sells a product is involved in chemistry. It is no wonder that the various areas of chemical and biochemical technology offer the largest field of employment in the physical sciences. Chemists are employed in fields such as:

- environmental analysis
- agriculture
- biotechnology
- pharmaceutical research
- waste management
- energy production
- forensic science
- petrochemical industry

Chemistry graduates will find many applications for their training in the fields of education, business, industry, law, government, and medicine.

Suggested Minors

A variety of minors can complement a major in chemistry. Some of the more popular minors in recent years have been biology, criminal justice, general business, and mathematics. Others have included education, history, political science, and psychology.

Student Organizations

Chemistry Club - The Chemistry Club is an active organization which encourages student interactions in a social atmosphere and which supports student travel to professional meetings.

Scholarships

Scholarships are available from the Department in Chemistry and from the University to support students' studies. For further information, contact the Chair, Department of Chemistry or visit the Department of Chemistry Home Page. Information on University scholarships may be obtained from the Office of Academic Scholarships website at www.shsu.edu/~sfa [www/scholarship.html](http://www.shsu.edu/~sfa/scholarship.html) or telephone (936) 294-1672.

Curriculum

Chemistry students learn how to critically examine and analyze observations, to use chemical understanding to propose solutions to problems of a quantitative or qualitative nature that may arise in industry, in academia or in various careers associated with chemistry. Students majoring in Chemistry have the opportunity for hands-on experience in working with atomic absorption, gas chromatography, high performance liquid chromatography, ultraviolet and visible spectroscopy, 60 MHz and 300 MHz nuclear magnetic resonance spectroscopy, mass spectrometry, ion chromatography, capillary electrophoresis, and other standard instrumentation in chemistry.

Required Courses for Major

Required courses: CHM 138/118, 139/119, 238/218, 239/219, 241, 410, 440, 448, 467 32 hrs.

Students will select one of the following tracks:

- BS for Professional Chemists: CHM 348, 426, 449, 495, CHM 3 hrs. Advanced 16 hrs.
- BS for Other Technical Careers: CHM 426, 495, CHM 3 hrs. Advanced 8 hrs.

Bachelor of Science Major in Chemistry for Professional Chemists

SHSU Course Number	Hours	Recommended Sequence
Core Curriculum		
Component Area I (Communication)	6	Freshman
Component Area II (Mathematics) ¹	3	Freshman
Component Area III (Natural Sciences)	8	Freshman or Sophomore
Component Area IV (Humanities/Visual/Performing Arts)	9	Throughout
Component Area V (Social/Behavioral Sciences)	15	Throughout
Component Area VI (Institutionally Designated Option)	1	
Degree Specific Requirements		
<u>MTH 142 <MATH 1420></u> ¹	4	Freshman
<u>MTH 143 <MATH 1430></u>	4	Freshman
<u>PHY 138/118 <PHYS 1301/1101></u> ²	4	Sophomore
<u>PHY 139/119 <PHYS 1302/1102></u>	4	Sophomore
<u>ENG 330 <ENGL 3330></u>	3	Sophomore or Junior
Major Core		
<u>CHM 138/118 <CHEM 1311/1111></u>	4	Freshman Fall term
<u>CHM 139/119 <CHEM 1312/1112></u>	4	Freshman Spring term

<u>CHM 238/218 <CHEM 2323/2123></u>	4	Sophomore Fall term
<u>CHM 239/CHM 219 <CHEM 2325/2125></u>	4	Sophomore Spring term
<u>CHM 241 <CHEM 2401></u>	4	Sophomore or Junior
<u>CHM 348 <CHEM 3438></u>	4	Junior or Senior Fall term
<u>CHM 448 <CHEM 4448></u>	4	Junior Fall term
<u>CHM 449 <CHEM 4449></u>	4	Junior Spring term
<u>CHM 440 <CHEM 4440></u>	4	Junior or Senior Fall term
<u>CHM 426 <CHEM 4260></u>	2	Senior Spring term
<u>CHM 467 <CHEM 4367></u>	3	Senior Spring term
<u>CHM 410 <CHEM 4100></u>	1	Junior or Senior
<u>CHM 495 <CHEM 4395></u>	3	Junior or Senior
CHM <CHEM> Advanced elective	3	Junior or Senior
Minor (if required)		
A minor, including 6 advanced hours is required. ³	18	
Electives		
General electives	6	
Advanced electives	6	
Total Hours:	120-128	

Notes: ¹MTH 142 satisfies the Component Area II requirement and the degree specific requirement.

²PHY 138/118 and PHY 139/119 satisfy the Component Area III requirement and the degree specific requirement.

³A minor in MTH, for instance, only requires 10 additional hours beyond MTH 142 & 143.

CHM 367, 368, 339, 442, and 443 are recommended.

A minor requires six semesters of coursework, a minimum of 18 credits (six advanced) in an approved field.

Students should use elective and minor hours to satisfy the 42 advanced hour requirement.

*****3 Digit to 4 Digit Crosswalk*****

Bachelor of Science

Major in Chemistry Other Technical Careers

SHSU Course Number	Hours	Recommended Sequence
Core Curriculum		
Component Area I (Communication) ¹	6	Freshman
Component Area II (Mathematics)	3	Freshman

Component Area III (Natural Sciences)	8	Freshman or Sophomore
Component Area IV (Humanities/Visual/Performing Arts)	9	Throughout
Component Area V (Social/Behavioral Sciences)	15	Throughout
Component Area VI (Institutionally Designated Option)	1	

Degree Specific Requirements

<u>MTH 142 <MATH 1420>¹</u>	4	Freshman
<u>MTH 143 <MATH 1430></u>	4	Freshman
<u>PHY 138/118 <PHYS 1301/1101>²</u>	4	Sophomore
<u>PHY 139/119 <PHYS 1302/1102></u>	4	Sophomore
<u>ENG 330 <ENGL 3330></u>	3	Sophomore or Junior

Major Core**Major**

<u>CHM 138/118 <CHEM 1311/1111></u>	4	Freshman Fall term
<u>CHM 139/119 <CHEM 1312/1112></u>	4	Freshman Spring term
<u>CHM 238/218 <CHEM 2323/2123></u>	4	Sophomore Fall term
<u>CHM 239/CHM 219 <CHEM 2325/2125></u>	4	Sophomore Spring term
<u>CHM 241 <CHEM 2401></u>	4	Sophomore or Junior
<u>CHM 448 <CHEM 4448></u>	4	Junior Fall term
<u>CHM 440 <CHEM 4440></u>	4	Junior or Senior Fall term
<u>CHM 426 <CHEM 4260></u>	2	Senior Spring term
<u>CHM 467 <CHEM 4367></u>	3	Senior Spring term
<u>CHM 410 <CHEM 4100></u>	1	Junior or Senior
<u>CHM 495 <CHEM 4395></u>	3	Junior or Senior
CHM Advanced elective	3	Junior or Senior

Minor (if required)

A minor, including 6 advanced hours is required.³ 18

Electives

General electives	6
Advanced electives	14

Total Hours: 120-120 Hours

Notes: ¹MTH 142 satisfies the Component Area II requirement and the degree specific requirement.

²PHY 138/118 and PHY 139/119 satisfy the Component Area III requirement and the degree specific requirement.

³A minor in MTH, for instance, only requires 10 additional hours beyond MTH 142 & 143.

CHM 367, 368, 339, 442, and 443 are recommended.

A minor requires six semesters of coursework, a minimum of 18 credits (six advanced) in an approved field.

Students should use elective and minor hours to satisfy the 42 advanced hour requirement.

Teacher Certification

Students seeking a background that will prepare them to teach chemistry at the secondary level should pursue a major in chemistry with a minor in secondary education.

Emphasis in Biochemistry-Biotechnology

Students seeking a background that will prepare them for the emerging technologies in biochemistry and biotechnology can select advanced courses that will lead to a major in chemistry and a minor in biology.

Emphasis in Forensic Science

Students seeking a background that will prepare them for careers in Forensic Science can select advanced courses that lead to a major in chemistry and a minor in Criminal Justice and/or Biology.

Bachelor of Science

Major in Forensic Chemistry

Students seeking background and training in the area of forensic science can get a Bachelor of Science in Forensic Chemistry with a Criminal Justice minor. This degree option educates students for careers in forensic chemistry in both private and government arenas and also prepares students to enter graduate schools in forensic science.

*****3 Digit to 4 Digit Crosswalk*****

Bachelor of Science

Major in Forensic Chemistry

SHSU Course Number	Hours	Recommended Sequence
Core Curriculum		
Component Area I (Communication)	6	Freshman
Component Area II (Mathematics) ¹	3	Freshman
Component Area III (Natural Sciences)	8	Freshman or Sophomore
Component Area IV (Humanities/Visual/Performing Arts)	9	Throughout
Component Area V (Social/Behavioral Sciences)	15	Throughout
Component Area VI (Institutionally Designated Option)	1	
Degree Specific Requirements		
<u>MTH 142 <MATH 1420></u> ¹	4	Freshman
<u>MTH 143 <MATH 1430></u>	4	Freshman
<u>PHY 138/118 <PHYS 1301/1101></u> ²	4	Sophomore
<u>PHY 139/119 <PHYS 1302/1102></u>	4	Sophomore
<u>ENG 330 <ENGL 3330></u>	3	Sophomore or Junior
<u>BIO 161/111 <BIOL 1311/1111></u>	4	Freshman
<u>BIO 162/112 <BIOL 1313/1113></u>	4	Freshman
<u>BIO 244 <BIOL 2440></u>	4	Sophomore
<u>BIO 345 <BIOL 3450></u>	4	Sophomore or Junior
Major Core		
Major		
<u>CHM 138/118 <CHEM 1311/1111></u>	4	Freshman Fall term
<u>CHM 139/119 <CHEM 1312/1112></u>	4	Freshman Spring term
<u>CHM 238/218 <CHEM 2323/2123></u>	4	Sophomore Fall term
<u>CHM 239/CHM 219 <CHEM 2325/2125></u>	4	Sophomore Spring term
<u>CHM 241 <CHEM 2401></u>	4	Sophomore or Junior
<u>CHM 348 <CHEM 3438></u>	4	Junior Fall term
<u>CHM 448 <CHEM 4448></u>	4	Junior Fall term

<u>CHM 410 <CHEM 4100></u>	1	Senior
<u>CHM 440 <CHEM 4440></u>	4	Senior Fall term
<u>CHM 467 <CHEM 4367></u>	3	Senior Spring term
<u>CHM 480 <CHEM 4380></u>	3	Senior Spring term

Minor (if required) CJ minor required

<u>CJ 261 <CRIJ 2361></u>	3	Sophomore
<u>CJ 262 <CRIJ 2362></u>	3	Sophomore
<u>CJ 264 <CRIJ 2364></u>	3	Junior
<u>CJ 366 <CRIJ 3366></u>	3	Junior
<u>CJ 378 <CRIJ 3378></u>	3	Senior
<u>CJ 485 <CRIJ 4385></u>	3	Senior

Electives

Advanced electives³ 7

Total Hours: 130 Hours

Notes: ¹MTH 142 satisfies the Component Area II requirement and the degree specific requirement.

²PHY 138/118 and PHY 139/119 satisfy the Component Area III requirement and the degree specific requirement.

³Students who are interested in the M.S. in Forensic Science program at SHSU are encouraged to take BIO 347 and 480 as the advanced electives.

Chemistry/Chemical Engineering**A Dual Degree Plan for Concurrent Bachelor of Science Degrees from Sam Houston State University and Universities with Recognized Accredited Chemical Engineering Degree Programs**

In this plan the student completes three years in Chemistry at Sam Houston State University and two years in Chemical Engineering at a university with a recognized accredited chemical engineering degree program. On successful completion of the curriculum shown below and the chemical engineering curriculum at a university with a recognized accredited degree program in chemical engineering, the student will receive two Bachelor of Science degrees, a Bachelor of Science with a major in Chemistry from Sam Houston State University, and a Bachelor of Science in Chemical Engineering from the university with the recognized accredited chemical engineering degree program.

*****3 Digit to 4 Digit Crosswalk*******Bachelor of Science****Major in Chemistry/Chemical Engineering**

SHSU Course Number	Hours	Recommended Sequence
Core Curriculum		
Component Area I (Communication)	6	Freshman
Component Area II (Mathematics) ¹	3	Freshman
Component Area III (Natural Sciences)	8	Freshman
Component Area IV (Humanities/Visual/Performing Arts)	9	Throughout
Component Area V (Social/Behavioral Sciences)	15	Throughout
Component Area VI (Institutionally Designated Option)	1	
Degree Specific Requirements		
<u>MTH 142 <MATH 1420></u> ¹	4	Freshman
<u>MTH 143 <MATH 1430></u>	4	Freshman
<u>MTH 244 <MATH 2440></u>	4	Sophomore
<u>MTH 376 <MATH 3376></u>	3	Junior
<u>PHY 141 <PHYS 1411></u>	4	Freshman
<u>PHY 142 <PHYS 1422></u>	4	Sophomore
<u>PHY 245 <PHYS 2426></u>	4	Sophomore
<u>IT 161 <ITEC 1361></u>	3	Junior
<u>ENG 330 <ENGL 3330></u>	3	Sophomore
Major Core		
Major		
<u>CHM 138/118 <CHEM 1311/1111></u> ²	4	Freshman Fall term
<u>CHM 139/119 <CHEM 1312/1112></u> ²	4	Freshman Spring term

<u>CHM 241 <CHEM 2401></u>	4	Sophomore
<u>CHM 238/218 <CHEM 2323/2123></u>	4	Sophomore Fall term
<u>CHM 239/CHM 219 <CHEM 2325/2125></u>	4	Sophomore Spring term
<u>CHM 448 <CHEM 4448></u>	4	Junior Fall term
<u>CHM 449 <CHEM 4449></u>	4	Junior Spring term
<u>CHM 410 <CHEM 4100></u>	1	Junior
<u>CHM 426 <CHEM 4260></u>	2	Junior Spring term
CHM Advanced elective	3	Junior

Minor (if required)

Two years (60 credit hours) of advanced courses in Chemical Engineering from a University with a Recognized Accredited (60) Senior and Fifth year Chemical Engineering Degree Program are also required

Total Hours: 98 + 60 Hours (98 at SHSU, 60 at a ChemE program)

Notes: ¹MTH 142 satisfies the Component Area II requirement and the degree specific requirement.

²CHM 138/118/139/119 satisfy the Component Area III requirements and major requirements.

Minor in Chemistry*****3 Digit to 4 Digit Crosswalk*****

A minor in Chemistry requires a minimum of six semesters of coursework and shall include CHM 138/118, 139/119, 238/218, 239/219, 241, and six semester hours of advanced chemistry including one advanced laboratory course. For students majoring in Food Science and Nutrition, the minor consists of CHM 138/118, 139/119, 238/218, 239/219, 348, and 339.



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Course Descriptions: C

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C

Career and Technology Course Descriptions

~~CAT 406 <CATM 4360> Work-based Mentorship.~~

~~Designed to provide students with the opportunity to gain specialized work-based experiences.~~

~~Prerequisite: Junior or senior standing. May be repeated or taken concurrently to a maximum of 9 hours. Writing enhanced. Credit 1-9.~~

NOTE: Sam Houston State University has adopted a four-digit course numbering system to become effective Summer 2011. Four-digit course numbers are indicated in the course descriptions in orange and within angle brackets < >.

Chemistry Course Descriptions

NOTE: THEA requirements for mathematics courses listed as prerequisites for chemistry courses are published in the current schedule of classes. These requirements are in addition to any prerequisites listed below.

CHM 115 <CHEM 1106> Inorganic and Environmental Chemistry Laboratory. [CHEM 1105]
Laboratory for CHM 135. Concurrent enrollment in CHM 135 <CHEM 1306> is recommended. Credit 1.

CHM 116 <CHEM 1107> Organic and Biochemistry Laboratory. [CHEM 1107]
Laboratory for CHM 136 <CHEM 1307>. Concurrent enrollment in CHM 136 <CHEM 1307> is recommended. Credit 1.

CHM 118 <CHEM 1111> General Chemistry I: Laboratory. [CHEM 1111]
Laboratory for CHM 138 <CHEM 1311>. Prerequisite: Prior credit for or concurrent enrollment in CHM 138 <CHEM 1311>. Credit 1.

CHM 119 <CHEM 1112> General Chemistry II: Laboratory. [CHEM 1112]
Laboratory for CHM 139. Prerequisite: A minimum grade of C in CHM 118 <CHEM 1111> and prior credit for or concurrent enrollment in CHM 139 <CHEM 1312>. Credit 1.

CHM 135 <CHEM 1306> Inorganic and Environmental Chemistry Lecture. [CHEM 1305]

The elements and their compounds are considered from a non-technical standpoint with emphasis placed on more familiar materials. This course is for non-science majors. Credit 3.

CHM 136 <CHEM 1307> Introductory Organic and Biochemistry Lecture. [CHEM 1307]

An orientation in organic chemistry is given in the first part of the course to allow treatment of the chemistry of nutrition and other biochemical aspects given in the last part. This course is for non-science majors. Prerequisite: CHM 135 <CHEM 1306>, CHM 138 <CHEM 1311> or completion of a high school chemistry course. Credit 3.

CHM 138 <CHEM 1311> General Chemistry I: Lecture. [CHEM 1311]

The following topics are studied: chemical changes and laws governing them; nomenclature; introduction to thermodynamics; reactions involving oxygen, hydrogen, acids, bases, and salts; ionization; metathesis; the periodic table, and atomic and molecular structure. This course is for chemistry and other science majors. Prerequisite: Minimum grade of C in MTH 163 <MATH 1316>, MTH 170 <MATH 1314>, MTH 199 <MATH 1324> or MTH 284 <MATH 2384> or equivalent, or a minimum Math score of 270 on the THEA (or equivalent). Fall, Spring, Summer I. Credit 3.

CHM 139 <CHEM 1312> General Chemistry II: Lecture. [CHEM 1312]

Descriptive chemistry, gas laws, equilibria, kinetics, thermodynamics, electrochemistry, and oxidation-reduction reactions are presented. Prerequisite: A minimum grade of C in CHM 138. Fall, Spring, Summer II. Credit 3.

CHM 238 <CHEM 2323> Organic Chemistry I: Lecture. [CHEM 2323]

A study of chemical bonding and structure of organic molecules is made. Functional group reactions and syntheses are emphasized. Reaction mechanisms, nomenclature and isomerism are studied. Prerequisite: A minimum grade of C in CHM 138/118 and 139/119. Fall, Spring, Summer I. Credit 3.

CHM 218 <CHEM 2123> Organic Chemistry I: Laboratory. [CHEM 2123]

Laboratory for CHM 238. Prerequisite: A minimum grade of C in CHM 119, and prior credit for or concurrent enrollment in CHM 238. Credit 1.

CHM 239 <CHEM 2325> Organic Chemistry II: Lecture. [CHEM 2325]

The general plan of CHM 238 <CHEM 2323> is continued. Fall, Spring, Summer II. Prerequisite: A minimum grade of C in CHM 139, 139 and 238. Credit 3.

CHM 219 <CHEM 2125> Organic Chemistry II: Laboratory. [CHEM 2125]

Laboratory for CHM 239. Prerequisite: A minimum grade of C in CHM 218, and prior credit for or concurrent enrollment in CHM 239. Credit 1.

CHM 241 <CHEM 2401> Quantitative Analysis.

The fundamental principles of quantitative analysis are emphasized. Acid-base, complexometric, precipitation, and redox titrations, solution equilibria and spectrophotometric analysis are discussed. Laboratory exercises involve all types of volumetric procedures and colorimetric analysis. Four-hour laboratory. Prerequisite: A minimum grade of C in CHM 138/118, 139/119. Fall, Spring. Credit 4.

CHM 339 <CHEM 3339> Metabolism.

This course is a study of the bioenergetics associated with the metabolic pathways and processes. The metabolism of carbohydrates, lipids, proteins, and nucleic acids; the interrelationship of the metabolic pathways; and the regulation of metabolism are emphasized. Prerequisite: A minimum grade of C in CHM 138/118, 139/119, 238/218, 239/219, and 348. Spring. Credit 3.

CHM 348 <CHEM 3438> Introductory Biochemistry.

The chemistry and functions of carbohydrates, lipids, proteins, enzymes, nucleic acids and vitamins; enzyme kinetics; the processes of and mechanisms of digestion and absorption; and biological buffers are studied. Four-hour laboratory. Writing Enhanced. Prerequisite: A minimum grade of C in CHM 138/118, 139/119, 238/218, 239/219. Fall. Credit 4.

CHM 361 <CHEM 3361> Discoveries in Chemistry and Textiles.

Attention will be focused on early scientists, the times in which they worked, important aspects of their

efforts, and how their research continues to impact us today. Lectures will occur in the geographical areas where their work took place. Prerequisite: CHM 135 <CHEM 1306> or CHM 138, junior standing, and permission of the instructor. Odd years during the Spring/Summer I break. Credit 3.

CHM 367 <CHEM 3367> Introductory Inorganic Chemistry.

General principles of inorganic chemistry are presented with a descriptive and practical rather than mathematical approach. Periodic relationships of elements and bonding, reactions and synthesis of inorganic compounds, acid-base chemistry are studied. Prerequisite: A minimum grade of C in CHM 138/118, 139/119, 238. Fall. Credit 3.

CHM 368 <CHEM 3368> Environmental Chemistry.

The chemical principles underlying the effects of air, water, and soil pollution are covered. Specific attention is paid to gas phase radical reactions, light absorption characteristics of atmospheric components, solution chemistry of fresh and salt water systems, and the mobility and chemistry of metal components of soil systems. Writing Enhanced. Prerequisite: A minimum grade of C in CHM 138/118, 139/119, 241, 238 and 239 (or concurrent enrollment in CHM 239). Spring even years. Credit 3.

CHM 410 <CHEM 4100> Chemical Literature Seminar.

Methods of searching the literature in chemistry are presented. Emphasis is placed on the use of Chemical Abstracts, Beilstein, chemical patent literature, journals, and reference collections in the several specialties of chemistry. Prerequisite: Junior standing in chemistry. Fall, Spring. Credit 1.

CHM 426 <CHEM 4260> Advanced Integrated Laboratory.

This course will involve in-depth experiments that require the use of sophisticated synthetic and analytical procedures in the areas of organic, inorganic or analytical chemistry. Writing Enhanced. Prerequisite: A minimum grade of C in CHM 138/118, 139/119, 238/218, 239/219, 241, 448. Spring. Credit 2.

CHM 440 <CHEM 4440> Instrumental Analytical Chemistry.

Spectrophotometry, separation techniques and mass spectrometry are discussed. Specific topics include the computer's use in the modern laboratory, ultraviolet and visible absorption, atomic absorption, flame emission, and inductively coupled plasma spectroscopy, infrared absorption, and gas and liquid chromatography. Instruments for these techniques are used in the laboratory work. Writing Enhanced. Prerequisite: A minimum grade of C in CHM 138/118, 139/119, 238, 239 and 241 and a minimum grade of C or concurrent enrollment in CHM 448. Four-hour laboratory. Fall. Credit 4.

CHM 441 <CHEM 4441> Methods for Environmental and Industrial Analysis.

This course covers the philosophy of modern instrumental methods used for environmental and industrial analyses. The topics to be covered include quality control and quality assurance good laboratory practices, waste minimization and elimination, safe laboratory operation, ISO standards, EPA methodology, and statistical data analysis. Prerequisites: A minimum grade of C in CHM 241, 238 and 239, and CHM 368. Spring. Credit 4.

CHM 442 <CHEM 4442> Air Quality.

An in-depth study of the sources of air pollution is made. Sampling procedures and the chemical analyses required for identification of pollutants are studied. Control methods for the restriction of air pollution are outlined. Four-hour laboratory. Prerequisite: A minimum grade of C in CHM 138/118, 139/119, 241, 238 and 239. Spring odd years. Credit 4.

CHM 443 <CHEM 4443> Structural Spectroscopic Methods.

A survey of the spectroscopic and spectrometric methods for elucidation of structural information for chemical compounds with emphasis on the structural identification of unknowns. The methods of ultraviolet-visible spectrophotometry, Fourier-transform infrared spectroscopy, mass spectrometry, and both one- and two-dimensional nuclear magnetic resonance spectroscopy will be covered. The relative strengths, complementary nature, and utility will be discussed. The focus will be the determination of chemical structures by spectroscopic/spectrometric methods. Writing Enhanced. Prerequisite: A minimum grade of C in CHM 138/118, 139/119, 238/218, 239/219. Spring even years. Credit 4.

CHM 448 <CHEM 4448> Physical Chemistry I.

The foundations of thermodynamics and spectroscopic methods (radio-frequency, microwave, infrared, Raman, UV-visible, and X-ray) are developed from first principals with an atomistic point of view. Four-hour laboratory. Writing Enhanced. Prerequisite: A minimum grade of C in CHM 138/118, 139/119, 238/218, 239/219, MTH 142, 143 and one year of physics. Fall. Credit 4.

CHM 449 <CHEM 4449> Physical Chemistry II.

The developments of thermochemistry, phase diagrams, equilibria, and kinetics are traced from the statistical mechanics of quantum states to the macroscopic observations of thermodynamics. Four-hour laboratory. Prerequisite: A minimum grade of C in CHM 138/118, 139/119, 238/218, 239/219, 448. Spring. Credit 4.

CHM 467 <CHEM 4367> Advanced Inorganic Chemistry.

Properties of atoms and ions, bonding theory and structure, acid-base theory, reactions of inorganic compounds, nonaqueous solvents, and coordination chemistry are studied. Emphasis is on the underlying theoretical concepts involved. Prerequisite: A minimum grade of C in CHM 138/118, 139/119, 238/218, 239/219, 448. Spring. Credit 3.

CHM 480 <CHEM 4380> Forensic Chemistry.

This is a one semester course focused on surveying important aspects of chemistry to forensic inquiries. Focus will be on the validity of results. Techniques and methods for selecting proper techniques to answer various questions will be discussed. Writing Enhanced. Prerequisite: A minimum grade of C in CHM 138/118, 139/119, 238/218, 239/219, 440 and 467 (or concurrent enrollment in CHM 467); MTH 142. Spring. Credit 3.

CHM 495 <CHEM 4395> Undergraduate Research in Chemistry.

This course acquaints the senior student with techniques used in simple research problems. Prerequisite: student must have a minimum of 20 semester hours in chemistry and consent of the Department Chair. May be repeated for an additional three semester hours by those students having a definite project to complete. This course may be taken for Academic Distinction credit. See [Academic Distinction Program](#) in this catalog. Credit 3.

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Communication Studies

COM 131 <COMS 1331> Introduction to Human Communication. [SPCH 1311]

A survey of the communication studies field. Students will be introduced to the basic principles, concepts, and modes of human communication in the contemporary world through class activities, projects, and lectures. Designed for non-majors. Credit 3.

COM 161 <COMS 1361> Public Speaking. [SPCH 1315]

An introductory course in research, composition, organization, and delivery of informative and persuasive speeches for various purposes and occasions. Includes strategies for reducing speaker apprehension. Credit 3.

COM 231 <COMS 2331> Introduction to Communication Theory and Research.

An introduction to theory and research in the field of communication with an emphasis on interpersonal and family communication. Students prepare reviews of literature as well as scholarly abstracts. Credit 3.

COM 233 <COMS 2333> Performance of Literature. [SPCH 2341]

Analytical Chemistry

(Primary reviewer's copy)

- Required
- Send in-depth course material if you teach a course in this curricular area
- Syllabi must include a list of topics taught
- All exams and finals must be included and labeled with the school name, course name, course number, and year taught
- Materials must be from courses taught in the last two academic years
- Staple the entire packet together. Use only one staple.**



Syllabus



Syllabus Chemistry 440 Instrumental Analytical Chemistry Fall 2010

Text:

- Required: Principles of Instrumental Analysis, 6th ed.; Skoog, Holler, and Crouch. (Thompson/Brooks/Cole Publishing; ISBN # 0495012017)
- Suggested Library resource: Handbook for Authors, American Chemical Society, T11.A4 1978

Class Meets in Chemistry/Forensic Science Room 101 or 103 TTh 9:30 - 11 am.

Lab Meets in Chemistry Forensic Science Room 309. Because of the extensive writing content of the laboratory reports this is a writing enhanced course.

Office hrs. 11:00am - 1:00pm MWF; 8:00am - 9:30am and 11:00am-noon Tuesday; 9:00 to 9:30 am Thursday; E-mail Office hours almost anytime

Chapter 1 Introduction

- • All pages
- • Picking an Instrument
- • Analog domain versus digital domain
- • Calibration
- • Figures of merit
- • Also make sure your computer account works

Chapter 4 Computers and Instrumental Labs

- • Pages 80-83; 87.25-89.4; 90.4-end
- • Binary data stored in memory locations
- • Base 2, Base 8, hexadecimal
- • Analog to digital conversion
- • The anatomy of a computer, memory, buses, microprocessor, display, storage
- • Computer applications for data processing
- • Instrumental Computer Networks

Chapter 5 Signals and Noise

- • Pages 113.75-114.4; 115.4-120.45; leave out equations; read about ELNs on p127.
- • Signal to noise ratio (S/N)
- • Degradation of S/N
- • Enhancement of S/N
- • Filtering

Chapter 6 Introduction to Spectrometric Methods

- • Pages 132-135.85; 144.25-end; lots of nomenclature here; eq. 6-2, 6-20; 6-21; 6-30 through 6-34.
- • Electromagnetic radiation, wavelengths, frequencies, energies
- • The photoelectric effect
- • Beers Law

Chapter 7 Components of Optical Instruments

- • Pages 164-171.75; 175.9-204.6
- • Light Sources
- • Monochromators
- • Light detectors
- • Digitally signal processing
- • Fourier Transform

Chapter 8-9 Atomic Absorption Spectroscopy

- • All pages
- • Historically, THE metals detection instrument
- • The "simple" atomic spectra
- • Atomization
- • Nebulizers
- • Electrothermal atomization
- • Double beam versus single beam AAS
- • AAS interferences

Chapter 10 Inductively Coupled Plasma

- • Pages 254-269.75
- • The wonder of the plasma, temperatures, configurations, importance of argon
- • Rowland circle sequential monochromators
- • Multichannel polychromators

Chapter 13-14 UV/VIS Spectrometry

- Equation 13-1; Table 13-1
- Pages 348.8-366; 367-370.4

Chapter 15 Molecular Luminescence

Pages 399-404.45; 410.25-417.8; 422.6-end

Chapter 16 IR Spectrometry

Pages 438.85-444.3; Figures 16-1, 16-7, 16-8, 16-9, 16-10, 16-12, 17-8, 17-5; Fourier primer:204.6-211

Chapter 27 Separation Science Starts with GC Separate then detect!

- • Pages: exclude 27A-1, -2 and -3; Start at 27B
- • Fundamentals of gas chromatography
- • Injectors
 - • Split/Splitless
 - • On-column
- • Ovens
- • Fast GC as the future
- • Columns
 - • The old metal column
 - • Capillary
 - • Megabore
 - • Microbore
- • Detectors (FID, ECD, TCD, FPD, NPD, SCD)

- • GCxGC introduction
- • Fast GC introduction

Chapter 30 Capillary Electrophoresis

- • Pages 867-882.4 (especially: CZE, CITP, and CIEF)
- • Electroosmotic flow
- • CZE
- • CITP
- • CIEF

Chapter 28 High Performance Liquid Chromatography

- • Pages 816-828.6; 839.25-844.5 and eq 26-22 and 26-16 in chapter 26
- • Multiport injectors
- • Pumps, columns and all that pressure
- • Detectors
- • Isocratic elution
- • Solvent programming

Chapter 27, 11, 20 GC/MS and Molecular Mass Spectrometry

Chapter 27 Gas Chromatography

- • Pages 798-800
- • Chromatographic Equations

Chapter 11 Atomic Mass spectrometry

- • Pages 281-294.25
- • Isotopes
- • Molecular ions
- • Daughter ions
- • Fragmentation

Chapter 20 Molecular Mass Spectrometry

- • Pages 550-558.75; 563.8-574.75; 577.9-end
- • Ion sources
 - • Electron impact
 - • Chemical ionization
- • Mass analyzers
 - • Magnetic sector
 - • Quadrupole
 - • Ion trap
- • Time of flight
- • GC/MS/MS

There will be three 80 minute long tests, and a two hour final:

- **The first test date is Thursday, September 23, 2010.**
- **The second test date is Thursday October 21, 2010.**
- **The third test date is Tuesday, November 23, 2010. (changed)**
- **The Final is scheduled for Tuesday, December 14, 2010 @ 8 am to 10 am. This is a two hour final.**

(The scheduled test dates are not negotiable but may be changed by the instructor.)

The grades in this class will be assigned in the following way:

- greater than 89.5% = final grade of A
- 79.5 to 89.5 B
- 69.5 to 79.5 C
- 59.5 to 69.5 D
- less than 59.5 F

Three 80 minute tests = 40%

The final = 20%

Lab reports = 25% (if two or more labs are not submitted the whole lab grade will be zero)

Class participation, forum postings, and attendance = 15%

Excessive absences, tardiness, or leaving early will adversely affect your grade in the course.



Attendance Policy

Attendance is required. Since this is a Tuesday/Thursday class, two unexcused absences per semester are allowed. Any tests missed because of unexcused absences will result in a grade of zero for that test. Excused absences include medical problems (with documentation from a doctor), death in the family, excused absences while conducting official Sam Houston State University business, or absences approved by the instructor before the time of the absence. Beginning with the third unexcused absence, the instructor reserves the right to lower the student's final course grade. Tardiness, or leaving class or lab early can also adversely affect your grade in the course. Information that the student needs to use to provide information to determine whether an absence is excused or not (doctor's excuse etc.) must be presented to the instructor within one week after the absence.



Required Calculator

To limit the use of memory-intensive calculators that can store text, formulae, and chemical nomenclature, you are required to use a Texas Instruments TI30 model calculator in this course **during in class tests**. There are multiple different TI30 models and all of them will work but I **suggest the TI30Xa**. Other calculators like TI Models TI34 and TI36 don't meet this requirement.



Purpose of This Course

The purpose of this 4 semester hour chemistry course is to provide a broad introduction to modern, analytical instrumental methods of chemical analysis.



Course Description

CHM 440 INSTRUMENTAL ANALYTICAL CHEMISTRY Spectrophotometry, separation techniques and mass spectrometry are discussed. Specific topics include the computer's use in the modern laboratory, ultraviolet and visible absorption, atomic absorption, flame emission, and inductively coupled plasma spectroscopy, infrared absorption, and gas and liquid chromatography. Instruments for these techniques are used in the laboratory work. Prerequisites: A minimum grade of C in CHM 238, and 239 and a minimum grade of C or concurrent enrollment in CHM 448. **Fall. Credit 4.**



Online Assignments

Note that the Blackboard server is routinely backed up in the middle of the night. When this occurs, Blackboard will not be available to you for as long as 1.5 hours. The time of the backup is somewhere around 3 am but may change. Before you arrange your schedule to routinely complete your online assignments in these wee hours, e-mail the SHSU help desk (helpdesk@shsu.edu) and ask them specifically "At what time is the Blackboard server NOT AVAILABLE because of maintenance or backup procedures?" then make your plans accordingly.



Missed Tests

There are no make-ups for unexcused absences on tests or the final. If you miss an exam for an unexcused absence then your grade on that exam is zero.

Excused absences included sickness that involves a doctor or health clinic visit, death in the immediate family, and emergency situations like fires or automobile accidents.

If you have an excused absence and can't attend a test, when you supply documentation for your absence a make-up exam will be scheduled. It is your responsibility to contact me as soon as possible after the missed test to begin this process. If you do not supply that documentation before the next scheduled test then the missed test grade becomes zero. In other words, excused absences require documentation.

If you miss a test or are going to miss a test it is in your best interest to contact me by phone (936) 294-1553 or e-mail as soon as you can.



Student Absences on Religious Holidays

An institution of higher education shall excuse a student from attending classes or other required activities, including examinations, for the observance of a religious holy day, including travel for that purpose. A student whose absence is excused under this subsection may not be penalized for that absence and shall be allowed to take an examination or complete an assignment from which the student is excused within a reasonable time after the absence. A student who plans to miss a class or required activity to observe a religious holy day should inform the professor in writing prior to planned absence.



Students with Disabilities

Services to Students with Disabilities

It is the policy of Sam Houston State University that no otherwise qualified disabled individual shall, solely by reason of his/her disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any academic, Student Life program or activity. Students with disabilities may request academic assistance when needed from a Committee for Continuing Academic Assistance for Disabled Students by visiting the director of the Counseling Center, located in the annex of the Lee Drain Building across the sidewalk from Farrington Building, or call (936) 294-1720 (For additional information see the University Catalog). For assistance other than academic, the student with disabilities should contact the department from which assistance is needed, such as University Police for parking, the Registrar's Office for registration, etc. If problems are not resolved on the departmental level, contact the Interim Coordinator, Americans with Disabilities Act, or call (936) 294-1015. Students with disabilities may benefit by using CCTVs and voice-activated reading machines available in the Counseling Center. Hours of operation are Monday - Friday, 8:00 a.m. to 5:00 p.m. For further information, contact the Counseling Center staff at (936) 294-1720. CCTV and a voice-activated reading machine are also available in the library.

Americans with Disabilities Act

SHSU adheres to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations for students with disabilities. If you have a disability that may affect adversely your work in this class, then I encourage you to register with the SHSU Counseling Center and to talk with me about how I can best help you.

All disclosures of disabilities will be kept strictly confidential. NOTE: no accommodation can be made until you register with the Counseling Center.



E-mail Forwarding

If you'd like to use an off campus e-mail address (for instance, Hotmail or Lycos) that's fine but you must have your student-address e-mail forwarded automatically because my general e-mail announcements automatically go to your student (stdabxxx@shsu.edu) account. E-

mail forwarding can be easily configured here: ww2.shsu.edu/mail03wp/ . You are utterly, totally, and completely responsible for successfully accomplishing this forwarding process.

Safari, FireFox, or Internet Explorer are required to use Blackboard. AOL's browser is not supported by Blackboard.



Academic Honesty

The Faculty Handbook states that the University expects all students to engage in all academic pursuits in a manner that is above reproach. Students are expected to maintain complete honesty and integrity in the academic experiences both in and out of the classroom. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. Furthermore, the University and its official representatives may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including, but not limited to, cheating on an examination or other academic work which is to be submitted, plagiarism, collusion and the abuse of resource materials.



Graduate Student Requirements

Student who take this course for graduate credit have additional requirements beyond those of undergraduate students.

First and foremost graduate students who are taking this course for credit must print and sign the document found in Bb CHM440>Course Documents>Graduate Credit Form. This must be done the first day of class.

The student's final course grade must be an A or B for graduate credit. Graduate students have additional/different questions on the in-class tests and final exam than those on undergraduate tests, although the number of tests will be the same. The additional material is designed to test graduate students at a more advanced level over the material covered in the class.

Additional laboratory requirements:

Literature Summaries

Two (2) brief literature summaries/abstracts from recent (< 5 years old) peer-reviewed journals are required as an appendix for each lab including the group labs (see NGL reference librarian for a reference book that will detail which journals are peer-reviewed and which not). This is written in the form of an abstract based on literature papers read along with the lab. The paper must describe the application of the technique employed in the lab experiment for that week.

Do not restate the paper's abstract for your summary; you must write your own. You must read at least the paper's introduction, the results, and the discussion. This must involve a journal citation which is made up of the names of the authors, the journal title, year, vol. number and page numbers (see format below). Put this at the top of your abstract (on the same page).

Also, you MUST include in your appendix a **copy of the first page** of each journal article referenced. this can be a photocopy for hard copy journals or printed for on-line sources.

Examples of analytical/forensic chemistry journals that are your primary sources include but are not limited to:

- Analytica Chimica Acta
- Analytical Chemistry

- Environmental Science and Technology
- Forensic Science International
- Journal of Chromatography
- Journal of Forensic Sciences
- Journal of Spectroscopy

Here is the format for journal citations:

Zhang, L. and T.G. Chasteen, Amending Cultures of Selenium Resistant Bacteria with Dimethyl Selenone, *Applied Organometallic Chemistry*, 1994, **8**, 501-508.

For papers in press:

Schaller, D., Hilder, E. F. and P. R. Haddad, Separation of antidepressants by capillary electrophoresis with in-line solid-phase extraction using a novel monolithic adsorbent, *Analytica Chimica Acta*, **in press**.

[XFALL 2010 CHM 440 01 INSTRUMENTAL ANALYTICAL CHEM \(CHM440011AF10\)](#) > [COURSE DOCUMENTS](#) > [NEWEST TENTATIVE LAB SCHEDULES](#) [EDIT VIEW](#)



Newest Tentative Lab Schedules



Tentative Lab Schedule 2010

- **Lab 1** Getting started with e-mail - Week of August 30 (no meeting in the lab; submit via e-mail to your TA)
- **Lab 2** Data crunching and linear regression - Week of September 6 (no meeting in the lab; submit via e-mail to your TA and put the hard copy with cover sheet in your TA's mail box in CFS317)
- **Lab 3** Pipetting and serial dilutions - Week of September 13 (first meeting in the lab)
- **Lab 4** AAS - Week of September 20
- **Lab 5** ICP/AES (This lab will be held at TRIES: 2424 Sam Houston Ave, Huntsville Texas) - Week of September 27
- **Lab 6** UV/vis Part I-- Week of October 4
- **Lab 7** UV/vis Part II - Week of October 11
- **Lab 8** GC 0 - Week of October 18
- **Lab 9** GC Part I - Week of October 25
- **Lab 10** GC Part II- Week of November 1
- **Lab 11** CE- Week of November 8
- **Lab 10** GC/MS Part I - Week of November 15 (this is a two week lab at TRIES)
Thanksgiving Vacation - Week of November 22
- **Lab 11** GC/MS Part II - Week of November 29
- **ACS Southwest Regional Meeting** - Week of November 29

OK

[XFALL 2010 CHM 440 01 INSTRUMENTAL ANALYTICAL CHEM \(CHM440011AF10\) > COURSE DOCUMENTS > DETAILED LABORATORY INSTRUCTIONS](#)

[EDIT VIEW](#)

 **Detailed Laboratory Instructions**

 **Detailed Lab Report Instructions**

Chemistry 440

Instrumental Analysis Laboratory

General Organization of Report Forms for All Experiments

- **I. Cover Page** (Name, Title of Experiment, Course, TA's Name, Date, staple in the upper left-hand corner)

For Group reports the following paragraph must be printed on the cover page:

For **Group lab reports**, failure on the part of any one of the report's authors to correctly reference the words of sources outside the Group that are written in the report--and represented as original writing--is plagiarism and all those in the Group are equally responsible. **Read that sentence again.** This means that merely signing off on the initial page--a requirement for CHM440 Group reports--and not checking the writing and references does not free coauthors of responsibility for the sections of other coauthors in the Group report. This is important and means that it is assumed that a frank discussion about these responsibilities has taken place among the Group's authors and their signatures on the report reflect recognition of those responsibilities. And finally, the signatures of each member of the Group signify that each student has read the final compiled report not just the individual section that a member has authored. This is a group project, not a cut and paste exercise.

- **II. Abstract** (This is typically 50 to 100 words long. It usually contains a very brief overview of the experiment, summary of the results, and any significant conclusions. Put the abstract on the cover page and label it 'Abstract'.)
- **III. Table of Contents List**, by page number, each section of the report, including page numbers of all graphics and attachments. You must include page numbers and your last name on the attachments). After you've printed make sure your table of contents' and printed pages number match.
- **IV. Introduction** (include the technique, a description of the chemical family, and a Chemdraw structure of the analyte when requested by TA.)
- **V. Instrumental Theory and Equipment** When you write these lab reports, they should be explained enough so a new chemistry 440 student can understand the theory of the instrument and the experiment that you did. Describe how the instrument functions. Include at least one schematic of the instrument **that you draw**, labeling all important components. Some schematics of the components themselves may be necessary. Provide a figure legend for each of the figure in your report. An example: **Figure 1. Schematic of an atomic absorption instrument.** If you use a figure from another source (be careful, you are required to draw most of your figures) then the figure legend must cite the source. In your text, you must explain each part in your schematic that you drew. Also include settings or important information regarding your experiment. Explain the function of ALL COMPONENTS. (It is hard to over-do it; and half efforts will lose points.) You must understand what a schematic diagram is. Questions? E-mail

your TA.

- **VI. Materials and Methods** This is where you describe the steps of the procedure you carried out. An example you might write in your report: "Working standards were prepared using a commercial metal standard (1000 ppm). Serial dilution was used to create a working range of 15 to 50 ppm Cu in 10% HCl.... Important steps in the calibration that were controlled by the software method included aspiration of blank, zeroing of base line, sample introduction, and wait for constant absorption" Use subscripts and superscripts correctly throughout your writing and in data tables and references. Word processors do this easily.

- **VII. Data and Experimental Results**

This section contains graphs, spectra, interpretations, all results obtained in the experiment (weights, volumes, **all calculations**, absorbance readings, etc.) etc. In other words all data you collected. Any graphs or tables should be labeled clearly and accurately such as the title and the axis). You should also include figure legends for graphs and tables in a manner that makes them self-explanatory. If you do not know what a figure legend is, please look at a couple reliable journal articles. Use the same type face (for instance Times, Helvetica, or Arial) to label all figures in the same report--i.e., be consistent). If you are determining an unknown, the unknown identity and any unknown number should be easily found as a logical portion of your discussion.

- **VIII. Conclusion and Discussion of Uncertainty** You need to include the purpose and goals of the experiments you performed (briefly), important data collected such as unknown identity or concentrations, etc., why your results are important and compare/contrast your results when needed. You must also include a short discussion of uncertainty in the data you collected. **Uncertainty is often referred to as experimental error**, but measured data uncertainties are not mistakes; they are simply limitations in the measuring process. For example, the four-place balance's last digit (the ten thousandths-place) is a source of uncertainty and always contains the least amount of precision for the readings of that device because of people walking around the room, particles from the air floating onto the machine, and the limitation these processes cause in determining that digit. Therefore a source of uncertainty in the lab using that device would be from the inherent limitations of the weighing process. Glassware (even volumetric glassware) also has uncertainty in the values generated using it (read the labels on the next piece of volumetric glassware you pick up). The experimental uncertainty arising from these limitations are independent of the human being taking the reading (a Nobel prize-winning analytical chemist would generate the same uncertainty in using the same 4-place balance). They are uncertainties due to the equipment/instrument used. So make a short list of the uncertainties inherent in the analytical techniques you're using in a particular lab. Which one is the most significant, that is, which one produces the largest un

Different applications of the instrument and where the instrument can be used needs to be state in the conclusion. Such as: AAS can be used in forensic science laboratory to detect lead or arsenic poisoning. Provide at least 3 different applications. Do not limit the applications to one field. You cannot use my examples. You must come up with your own.

- **IX. Assigned Questions** Answer all questions posed in the lab assignment in a separate section at the end of the lab. Answer these questions in your own words. Your TA has a copy of your textbook and will grade off when you copy definitions out of your text. Really! The TA reserves the right to add questions that are not mentioned in the lab discussion pages under COURSE DOCUMENTS on blackboard.

- **X. References** References carefully formatted as immediately below or following the American Chemical Society's Handbook for Authors (our library's call number T11.A4).

References should include citations for information found in the report, questions, and journal summaries (for grad students). **Make sure there is a clear citation for any literature summaries included in your report.** If you use material from our text then reference that.

Reference format:

- Reference to a journal article: Smith, A. B.; Jones, D. J. *Chem. Phys.* **1966**, *44*, 23.
 - Reference to a specific chapter in a book: Skoog, D. A.; Holler, E. J.; Nieman T. A. "Principles of Instrumental Analysis", 5th ed; Harcourt Brace College Publishers: Philadelphia, 1998; Chapter 13.
 - Reference to a specific page in a book: Skoog, D. A.; Holler, E. J.; Nieman T. A. "Principles of Instrumental Analysis", 5th ed; Harcourt Brace College Publishers: Philadelphia, 1998; p. 193.
 - Reference to specific pages in a book: Skoog, D. A.; Holler, E. J.; Nieman T. A. "Principles of Instrumental Analysis", 5th ed; Harcourt Brace College Publishers: Philadelphia, 1998; pp. 193-195.
 - Reference to a journal article in press: Pathem, B.A.; Vásquez, C. C.; Chasteen, T. G. *Anal. Biochem.* in press.
 - Reference to material from the web: URL: <http://www.oico.com/default.aspx?id=product&productID=57>; accessed October 1, 2012.
- **XI. Appendix** The appendix is mainly for attachments only, the printouts that come from the instruments. The printouts can be chromatograms, tables, or spreadsheets for any regressions (copies are OK if you want to keep your data). **Do not** put your graphs or the calculations in this section. Ask your TA by e-mail if you have a question about the report.

All reports must be prepared using word-processing, spreadsheet and drawing (CAD) software. This is a writing enhanced course and you will be scored accordingly. Spelling, grammar, formatting, and layout are all important aspects of your finished report and can affect the outcome of the grade you get for the report. If you have questions e-mail your TA. Not asking is worse than asking. As a matter of fact asking will only get you more information.

Laboratory Period Schedule

In order for this lab to run more smoothly, it is very important that you come to lab prepared. It is also important that you make it to lab on time. Each week you will be put into groups and each group will have a limited time in the lab. If you come in late, do not expect to run over into another group's time. Lab reports are due when you come into the lab. I WILL NOT accept late labs. Labs are not repeatable, so don't plan anything else for your Thursday afternoons. If you have a legitimate reason for needing to be placed in a certain group, please let me know at least a week in advance and I will do what I can. Commuting to school or wanting to go home early because your ride wants to leave early are not legitimate reasons to ask for a modification of the group to which you are assigned. You are required to be present for the entire four hour lab 1-5 PM every Thursday or Friday, and plan your commuting schedule accordingly. If you get out early then you can begin working in the computer lab, etc. We will do our best to optimize our and your time in this regard, but don't assume you'll always leave early.

Laboratory Report Schedule

Lab reports are due the following week after the lab is performed when your group comes into the lab. These reports will take a considerable amount of time to prepare so don't put it off until Wednesday (or Thursday) night, or, we can say from experience, you will probably be sorry. All

graphs and charts must be digitally inserted into the text of your report--you might need to go to the computer lab and ask a lab techie to learn how to do this in the beginning, but it is a skill worth learning, and frankly you will not be able to pass the lab without exhibiting substantial productivity with the personal computer. **Keep in mind that a significant part of this lab is learning how to present information in a professional manner, and as a formal writing project misspelled words, grammatical errors, and the way you present your data are all part of your grade in this writing enhanced course.**

Laboratory Safety

Lab safety is very important. You are responsible for knowing the departmental safety rules and following them. You must wear lab goggles the entire time you are in the lab. It is also mandatory that you wear long pants and long sleeves in lab. Violating the safety rules can result in a lowering of grade, loss of entire grade on a lab, or failure in the course.

Have questions or need help? [E-mail to your TA](#)

OK

Analytical Chemistry

(Primary reviewer's copy)

- Required
- Send in-depth course material if you teach a course in this curricular area
- Syllabi must include a list of topics taught
- All exams and finals must be included and labeled with the school name, course name, course number, and year taught
- Materials must be from courses taught in the last two academic years
- Staple the entire packet together. Use only one staple.**



Syllabus



Syllabus Chemistry 440 Instrumental Analytical Chemistry Fall 2010

Text:

- Required: Principles of Instrumental Analysis, 6th ed.; Skoog, Holler, and Crouch. (Thompson/Brooks/Cole Publishing; ISBN # 0495012017)
- Suggested Library resource: Handbook for Authors, American Chemical Society, T11.A4 1978

Class Meets in Chemistry/Forensic Science Room 101 or 103 TTh 9:30 - 11 am.

Lab Meets in Chemistry Forensic Science Room 309. Because of the extensive writing content of the laboratory reports this is a writing enhanced course.

Office hrs. 11:00am - 1:00pm MWF; 8:00am - 9:30am and 11:00am-noon Tuesday; 9:00 to 9:30 am Thursday; E-mail Office hours almost anytime

Chapter 1 Introduction

- • All pages
- • Picking an Instrument
- • Analog domain versus digital domain
- • Calibration
- • Figures of merit
- • Also make sure your computer account works

Chapter 4 Computers and Instrumental Labs

- • Pages 80-83; 87.25-89.4; 90.4-end
- • Binary data stored in memory locations
- • Base 2, Base 8, hexadecimal
- • Analog to digital conversion
- • The anatomy of a computer, memory, buses, microprocessor, display, storage
- • Computer applications for data processing
- • Instrumental Computer Networks

Chapter 5 Signals and Noise

- • Pages 113.75-114.4; 115.4-120.45; leave out equations; read about ELNs on p127.
- • Signal to noise ratio (S/N)
- • Degradation of S/N
- • Enhancement of S/N
- • Filtering

Chapter 6 Introduction to Spectrometric Methods

- • Pages 132-135.85; 144.25-end; lots of nomenclature here; eq. 6-2, 6-20; 6-21; 6-30 through 6-34.
- • Electromagnetic radiation, wavelengths, frequencies, energies
- • The photoelectric effect
- • Beers Law

Chapter 7 Components of Optical Instruments

- • Pages 164-171.75; 175.9-204.6
- • Light Sources
- • Monochromators
- • Light detectors
- • Digitally signal processing
- • Fourier Transform

Chapter 8-9 Atomic Absorption Spectroscopy

- • All pages
- • Historically, THE metals detection instrument
- • The "simple" atomic spectra
- • Atomization
- • Nebulizers
- • Electrothermal atomization
- • Double beam versus single beam AAS
- • AAS interferences

Chapter 10 Inductively Coupled Plasma

- • Pages 254-269.75
- • The wonder of the plasma, temperatures, configurations, importance of argon
- • Rowland circle sequential monochromators
- • Multichannel polychromators

Chapter 13-14 UV/VIS Spectrometry

- • Equation 13-1; Table 13-1
- • Pages 348.8-366; 367-370.4

Chapter 15 Molecular Luminescence

Pages 399-404.45; 410.25-417.8; 422.6-end

Chapter 16 IR Spectrometry

Pages 438.85-444.3; Figures 16-1, 16-7, 16-8, 16-9, 16-10, 16-12, 17-8, 17-5; Fourier primer:204.6-211

Chapter 27 Separation Science Starts with GC Separate then detect!

- • Pages: exclude 27A-1, -2 and -3; Start at 27B
- • Fundamentals of gas chromatography
- • Injectors
 - • Split/Splitless
 - • On-column
- • Ovens
- • Fast GC as the future
- • Columns
 - • The old metal column
 - • Capillary
 - • Megabore
 - • Microbore
- • Detectors (FID, ECD, TCD, FPD, NPD, SCD)

- • GCxGC introduction
- • Fast GC introduction

Chapter 30 Capillary Electrophoresis

- • Pages 867-882.4 (especially: CZE, CITP, and CIEF)
- • Electroosmotic flow
- • CZE
- • CITP
- • CIEF

Chapter 28 High Performance Liquid Chromatography

- • Pages 816-828.6; 839.25-844.5 and eq 26-22 and 26-16 in chapter 26
- • Multiport injectors
- • Pumps, columns and all that pressure
- • Detectors
- • Isocratic elution
- • Solvent programming

Chapter 27, 11, 20 GC/MS and Molecular Mass Spectrometry

Chapter 27 Gas Chromatography

- • Pages 798-800
- • Chromatographic Equations

Chapter 11 Atomic Mass spectrometry

- • Pages 281-294.25
- • Isotopes
- • Molecular ions
- • Daughter ions
- • Fragmentation

Chapter 20 Molecular Mass Spectrometry

- • Pages 550-558.75; 563.8-574.75; 577.9-end
- • Ion sources
 - • Electron impact
 - • Chemical ionization
- • Mass analyzers
 - • Magnetic sector
 - • Quadrupole
 - • Ion trap
- • Time of flight
- • GC/MS/MS

There will be three 80 minute long tests, and a two hour final:

- **The first test date is Thursday, September 23, 2010.**
- **The second test date is Thursday October 21, 2010.**
- **The third test date is Tuesday, November 23, 2010. (changed)**
- **The Final is scheduled for Tuesday, December 14, 2010 @ 8 am to 10 am. This is a two hour final.**

(The scheduled test dates are not negotiable but may be changed by the instructor.)

The grades in this class will be assigned in the following way:

- greater than 89.5% = final grade of A
- 79.5 to 89.5 B
- 69.5 to 79.5 C
- 59.5 to 69.5 D
- less than 59.5 F

Three 80 minute tests = 40%

The final = 20%

Lab reports = 25% (if two or more labs are not submitted the whole lab grade will be zero)

Class participation, forum postings, and attendance = 15%

Excessive absences, tardiness, or leaving early will adversely affect your grade in the course.



Attendance Policy

Attendance is required. Since this is a Tuesday/Thursday class, two unexcused absences per semester are allowed. Any tests missed because of unexcused absences will result in a grade of zero for that test. Excused absences include medical problems (with documentation from a doctor), death in the family, excused absences while conducting official Sam Houston State University business, or absences approved by the instructor before the time of the absence. Beginning with the third unexcused absence, the instructor reserves the right to lower the student's final course grade. Tardiness, or leaving class or lab early can also adversely affect your grade in the course. Information that the student needs to use to provide information to determine whether an absence is excused or not (doctor's excuse etc.) must be presented to the instructor within one week after the absence.



Required Calculator

To limit the use of memory-intensive calculators that can store text, formulae, and chemical nomenclature, you are required to use a Texas Instruments TI30 model calculator in this course **during in class tests**. There are multiple different TI30 models and all of them will work but I **suggest the TI30Xa**. Other calculators like TI Models TI34 and TI36 don't meet this requirement.



Purpose of This Course

The purpose of this 4 semester hour chemistry course is to provide a broad introduction to modern, analytical instrumental methods of chemical analysis.



Course Description

CHM 440 INSTRUMENTAL ANALYTICAL CHEMISTRY Spectrophotometry, separation techniques and mass spectrometry are discussed. Specific topics include the computer's use in the modern laboratory, ultraviolet and visible absorption, atomic absorption, flame emission, and inductively coupled plasma spectroscopy, infrared absorption, and gas and liquid chromatography. Instruments for these techniques are used in the laboratory work. Prerequisites: A minimum grade of C in CHM 238, and 239 and a minimum grade of C or concurrent enrollment in CHM 448. **Fall. Credit 4.**



Online Assignments

Note that the Blackboard server is routinely backed up in the middle of the night. When this occurs, Blackboard will not be available to you for as long as 1.5 hours. The time of the backup is somewhere around 3 am but may change. Before you arrange your schedule to routinely complete your online assignments in these wee hours, e-mail the SHSU help desk (helpdesk@shsu.edu) and ask them specifically "At what time is the Blackboard server NOT AVAILABLE because of maintenance or backup procedures?" then make your plans accordingly.



Missed Tests

There are no make-ups for unexcused absences on tests or the final. If you miss an exam for an unexcused absence then your grade on that exam is zero.

Excused absences included sickness that involves a doctor or health clinic visit, death in the immediate family, and emergency situations like fires or automobile accidents.

If you have an excused absence and can't attend a test, when you supply documentation for your absence a make-up exam will be scheduled. It is your responsibility to contact me as soon as possible after the missed test to begin this process. If you do not supply that documentation before the next scheduled test then the missed test grade becomes zero. In other words, excused absences require documentation.

If you miss a test or are going to miss a test it is in your best interest to contact me by phone (936) 294-1553 or e-mail as soon as you can.



Student Absences on Religious Holidays

An institution of higher education shall excuse a student from attending classes or other required activities, including examinations, for the observance of a religious holy day, including travel for that purpose. A student whose absence is excused under this subsection may not be penalized for that absence and shall be allowed to take an examination or complete an assignment from which the student is excused within a reasonable time after the absence. A student who plans to miss a class or required activity to observe a religious holy day should inform the professor in writing prior to planned absence.



Students with Disabilities

Services to Students with Disabilities

It is the policy of Sam Houston State University that no otherwise qualified disabled individual shall, solely by reason of his/her disability, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any academic, Student Life program or activity. Students with disabilities may request academic assistance when needed from a Committee for Continuing Academic Assistance for Disabled Students by visiting the director of the Counseling Center, located in the annex of the Lee Drain Building across the sidewalk from Farrington Building, or call (936) 294-1720 (For additional information see the University Catalog). For assistance other than academic, the student with disabilities should contact the department from which assistance is needed, such as University Police for parking, the Registrar's Office for registration, etc. If problems are not resolved on the departmental level, contact the Interim Coordinator, Americans with Disabilities Act, or call (936) 294-1015. Students with disabilities may benefit by using CCTVs and voice-activated reading machines available in the Counseling Center. Hours of operation are Monday - Friday, 8:00 a.m. to 5:00 p.m. For further information, contact the Counseling Center staff at (936) 294-1720. CCTV and a voice-activated reading machine are also available in the library.

Americans with Disabilities Act

SHSU adheres to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations for students with disabilities. If you have a disability that may affect adversely your work in this class, then I encourage you to register with the SHSU Counseling Center and to talk with me about how I can best help you.

All disclosures of disabilities will be kept strictly confidential. NOTE: no accommodation can be made until you register with the Counseling Center.



E-mail Forwarding

If you'd like to use an off campus e-mail address (for instance, Hotmail or Lycos) that's fine but you must have your student-address e-mail forwarded automatically because my general e-mail announcements automatically go to your student (stdabxxx@shsu.edu) account. E-

mail forwarding can be easily configured here: ww2.shsu.edu/mail03wp/ . You are utterly, totally, and completely responsible for successfully accomplishing this forwarding process.

Safari, FireFox, or Internet Explorer are required to use Blackboard. AOL's browser is not supported by Blackboard.



Academic Honesty

The Faculty Handbook states that the University expects all students to engage in all academic pursuits in a manner that is above reproach. Students are expected to maintain complete honesty and integrity in the academic experiences both in and out of the classroom. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. Furthermore, the University and its official representatives may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including, but not limited to, cheating on an examination or other academic work which is to be submitted, plagiarism, collusion and the abuse of resource materials.



Graduate Student Requirements

Student who take this course for graduate credit have additional requirements beyond those of undergraduate students.

First and foremost graduate students who are taking this course for credit must print and sign the document found in Bb CHM440>Course Documents>Graduate Credit Form. This must be done the first day of class.

The student's final course grade must be an A or B for graduate credit. Graduate students have additional/different questions on the in-class tests and final exam than those on undergraduate tests, although the number of tests will be the same. The additional material is designed to test graduate students at a more advanced level over the material covered in the class.

Additional laboratory requirements:

Literature Summaries

Two (2) brief literature summaries/abstracts from recent (< 5 years old) peer-reviewed journals are required as an appendix for each lab including the group labs (see NGL reference librarian for a reference book that will detail which journals are peer-reviewed and which not). This is written in the form of an abstract based on literature papers read along with the lab. The paper must describe the application of the technique employed in the lab experiment for that week.

Do not restate the paper's abstract for your summary; you must write your own. You must read at least the paper's introduction, the results, and the discussion. This must involve a journal citation which is made up of the names of the authors, the journal title, year, vol. number and page numbers (see format below). Put this at the top of your abstract (on the same page).

Also, you **MUST** include in your appendix a **copy of the first page** of each journal article referenced. this can be a photocopy for hard copy journals or printed for on-line sources.

Examples of analytical/forensic chemistry journals that are your primary sources include but are not limited to:

- Analytica Chimica Acta
- Analytical Chemistry

- Environmental Science and Technology
- Forensic Science International
- Journal of Chromatography
- Journal of Forensic Sciences
- Journal of Spectroscopy

Here is the format for journal citations:

Zhang, L. and T.G. Chasteen, Amending Cultures of Selenium Resistant Bacteria with Dimethyl Selenone, *Applied Organometallic Chemistry*, 1994, **8**, 501-508.

For papers in press:

Schaller, D., Hilder, E. F. and P. R. Haddad, Separation of antidepressants by capillary electrophoresis with in-line solid-phase extraction using a novel monolithic adsorbent, *Analytica Chimica Acta*, **in press**.

[XFALL 2010 CHM 440 01 INSTRUMENTAL ANALYTICAL CHEM \(CHM440011AF10\)](#) > [COURSE DOCUMENTS](#) > [NEWEST TENTATIVE LAB SCHEDULES](#) [EDIT VIEW](#)



Newest Tentative Lab Schedules



Tentative Lab Schedule 2010

- **Lab 1** Getting started with e-mail - Week of August 30 (no meeting in the lab; submit via e-mail to your TA)
- **Lab 2** Data crunching and linear regression - Week of September 6 (no meeting in the lab; submit via e-mail to your TA and put the hard copy with cover sheet in your TA's mail box in CFS317)
- **Lab 3** Pipetting and serial dilutions - Week of September 13 (first meeting in the lab)
- **Lab 4** AAS - Week of September 20
- **Lab 5** ICP/AES (This lab will be held at TRIES: 2424 Sam Houston Ave, Huntsville Texas) - Week of September 27
- **Lab 6** UV/vis Part I-- Week of October 4
- **Lab 7** UV/vis Part II - Week of October 11
- **Lab 8** GC 0 - Week of October 18
- **Lab 9** GC Part I - Week of October 25
- **Lab 10** GC Part II- Week of November 1
- **Lab 11** CE- Week of November 8
- **Lab 10** GC/MS Part I - Week of November 15 (this is a two week lab at TRIES)
Thanksgiving Vacation - Week of November 22
- **Lab 11** GC/MS Part II - Week of November 29
- **ACS Southwest Regional Meeting** - Week of November 29

OK

[XFALL 2010 CHM 440 01 INSTRUMENTAL ANALYTICAL CHEM \(CHM440011AF10\) > COURSE DOCUMENTS > DETAILED LABORATORY INSTRUCTIONS](#)

[EDIT VIEW](#)

 **Detailed Laboratory Instructions**

 **Detailed Lab Report Instructions**

Chemistry 440

Instrumental Analysis Laboratory

General Organization of Report Forms for All Experiments

- **I. Cover Page** (Name, Title of Experiment, Course, TA's Name, Date, staple in the upper left-hand corner)

For Group reports the following paragraph must be printed on the cover page:

For **Group lab reports**, failure on the part of any one of the report's authors to correctly reference the words of sources outside the Group that are written in the report--and represented as original writing--is plagiarism and all those in the Group are equally responsible. **Read that sentence again.** This means that merely signing off on the initial page--a requirement for CHM440 Group reports--and not checking the writing and references does not free coauthors of responsibility for the sections of other coauthors in the Group report. This is important and means that it is assumed that a frank discussion about these responsibilities has taken place among the Group's authors and their signatures on the report reflect recognition of those responsibilities. And finally, the signatures of each member of the Group signify that each student has read the final compiled report not just the individual section that a member has authored. This is a group project, not a cut and paste exercise.

- **II. Abstract** (This is typically 50 to 100 words long. It usually contains a very brief overview of the experiment, summary of the results, and any significant conclusions. Put the abstract on the cover page and label it 'Abstract'.)
- **III. Table of Contents List**, by page number, each section of the report, including page numbers of all graphics and attachments. You must include page numbers and your last name on the attachments). After you've printed make sure your table of contents' and printed pages number match.
- **IV. Introduction** (include the technique, a description of the chemical family, and a Chemdraw structure of the analyte when requested by TA.)
- **V. Instrumental Theory and Equipment** When you write these lab reports, they should be explained enough so a new chemistry 440 student can understand the theory of the instrument and the experiment that you did. Describe how the instrument functions. Include at least one schematic of the instrument **that you draw**, labeling all important components. Some schematics of the components themselves may be necessary. Provide a figure legend for each of the figure in your report. An example: **Figure 1. Schematic of an atomic absorption instrument.** If you use a figure from another source (be careful, you are required to draw most of your figures) then the figure legend must cite the source. In your text, you must explain each part in your schematic that you drew. Also include settings or important information regarding your experiment. Explain the function of ALL COMPONENTS. (It is hard to over-do it; and half efforts will lose points.) You must understand what a schematic diagram is. Questions? E-mail

your TA.

- **VI. Materials and Methods** This is where you describe the steps of the procedure you carried out. An example you might write in your report: "Working standards were prepared using a commercial metal standard (1000 ppm). Serial dilution was used to create a working range of 15 to 50 ppm Cu in 10% HCl.... Important steps in the calibration that were controlled by the software method included aspiration of blank, zeroing of base line, sample introduction, and wait for constant absorption" Use subscripts and superscripts correctly throughout your writing and in data tables and references. Word processors do this easily.

- **VII. Data and Experimental Results**

This section contains graphs, spectra, interpretations, all results obtained in the experiment (weights, volumes, **all calculations**, absorbance readings, etc.) etc. In other words all data you collected. Any graphs or tables should be labeled clearly and accurately such as the title and the axis). You should also include figure legends for graphs and tables in a manner that makes them self-explanatory. If you do not know what a figure legend is, please look at a couple reliable journal articles. Use the same type face (for instance Times, Helvetica, or Arial) to label all figures in the same report--i.e., be consistent). If you are determining an unknown, the unknown identity and any unknown number should be easily found as a logical portion of your discussion.

- **VIII. Conclusion and Discussion of Uncertainty** You need to include the purpose and goals of the experiments you performed (briefly), important data collected such as unknown identity or concentrations, etc., why your results are important and compare/contrast your results when needed. You must also include a short discussion of uncertainty in the data you collected. **Uncertainty is often referred to as experimental error**, but measured data uncertainties are not mistakes; they are simply limitations in the measuring process. For example, the four-place balance's last digit (the ten thousandths-place) is a source of uncertainty and always contains the least amount of precision for the readings of that device because of people walking around the room, particles from the air floating onto the machine, and the limitation these processes cause in determining that digit. Therefore a source of uncertainty in the lab using that device would be from the inherent limitations of the weighing process. Glassware (even volumetric glassware) also has uncertainty in the values generated using it (read the labels on the next piece of volumetric glassware you pick up). The experimental uncertainty arising from these limitations are independent of the human being taking the reading (a Nobel prize-winning analytical chemist would generate the same uncertainty in using the same 4-place balance). They are uncertainties due to the equipment/instrument used. So make a short list of the uncertainties inherent in the analytical techniques you're using in a particular lab. Which one is the most significant, that is, which one produces the largest un

Different applications of the instrument and where the instrument can be used needs to be state in the conclusion. Such as: AAS can be used in forensic science laboratory to detect lead or arsenic poisoning. Provide at least 3 different applications. Do not limit the applications to one field. You cannot use my examples. You must come up with your own.

- **IX. Assigned Questions** Answer all questions posed in the lab assignment in a separate section at the end of the lab. Answer these questions in your own words. Your TA has a copy of your textbook and will grade off when you copy definitions out of your text. Really! The TA reserves the right to add questions that are not mentioned in the lab discussion pages under COURSE DOCUMENTS on blackboard.

- **X. References** References carefully formatted as immediately below or following the American Chemical Society's Handbook for Authors (our library's call number T11.A4).

References should include citations for information found in the report, questions, and journal summaries (for grad students). **Make sure there is a clear citation for any literature summaries included in your report.** If you use material from our text then reference that.

Reference format:

- Reference to a journal article: Smith, A. B.; Jones, D. J. *Chem. Phys.* **1966**, *44*, 23.
 - Reference to a specific chapter in a book: Skoog, D. A.; Holler, E. J.; Nieman T. A. "Principles of Instrumental Analysis", 5th ed; Harcourt Brace College Publishers: Philadelphia, 1998; Chapter 13.
 - Reference to a specific page in a book: Skoog, D. A.; Holler, E. J.; Nieman T. A. "Principles of Instrumental Analysis", 5th ed; Harcourt Brace College Publishers: Philadelphia, 1998; p. 193.
 - Reference to specific pages in a book: Skoog, D. A.; Holler, E. J.; Nieman T. A. "Principles of Instrumental Analysis", 5th ed; Harcourt Brace College Publishers: Philadelphia, 1998; pp. 193-195.
 - Reference to a journal article in press: Pathem, B.A.; Vásquez, C. C.; Chasteen, T. G. *Anal. Biochem.* in press.
 - Reference to material from the web: URL: <http://www.oico.com/default.aspx?id=product&productID=57>; accessed October 1, 2012.
- **XI. Appendix** The appendix is mainly for attachments only, the printouts that come from the instruments. The printouts can be chromatograms, tables, or spreadsheets for any regressions (copies are OK if you want to keep your data). **Do not** put your graphs or the calculations in this section. Ask your TA by e-mail if you have a question about the report.

All reports must be prepared using word-processing, spreadsheet and drawing (CAD) software. This is a writing enhanced course and you will be scored accordingly. Spelling, grammar, formatting, and layout are all important aspects of your finished report and can affect the outcome of the grade you get for the report. If you have questions e-mail your TA. Not asking is worse than asking. As a matter of fact asking will only get you more information.

Laboratory Period Schedule

In order for this lab to run more smoothly, it is very important that you come to lab prepared. It is also important that you make it to lab on time. Each week you will be put into groups and each group will have a limited time in the lab. If you come in late, do not expect to run over into another group's time. Lab reports are due when you come into the lab. I WILL NOT accept late labs. Labs are not repeatable, so don't plan anything else for your Thursday afternoons. If you have a legitimate reason for needing to be placed in a certain group, please let me know at least a week in advance and I will do what I can. Commuting to school or wanting to go home early because your ride wants to leave early are not legitimate reasons to ask for a modification of the group to which you are assigned. You are required to be present for the entire four hour lab 1-5 PM every Thursday or Friday, and plan your commuting schedule accordingly. If you get out early then you can begin working in the computer lab, etc. We will do our best to optimize our and your time in this regard, but don't assume you'll always leave early.

Laboratory Report Schedule

Lab reports are due the following week after the lab is performed when your group comes into the lab. These reports will take a considerable amount of time to prepare so don't put it off until Wednesday (or Thursday) night, or, we can say from experience, you will probably be sorry. All

graphs and charts must be digitally inserted into the text of your report--you might need to go to the computer lab and ask a lab techie to learn how to do this in the beginning, but it is a skill worth learning, and frankly you will not be able to pass the lab without exhibiting substantial productivity with the personal computer. **Keep in mind that a significant part of this lab is learning how to present information in a professional manner, and as a formal writing project misspelled words, grammatical errors, and the way you present your data are all part of your grade in this writing enhanced course.**

Laboratory Safety

Lab safety is very important. You are responsible for knowing the departmental safety rules and following them. You must wear lab goggles the entire time you are in the lab. It is also mandatory that you wear long pants and long sleeves in lab. Violating the safety rules can result in a lowering of grade, loss of entire grade on a lab, or failure in the course.

Have questions or need help? [E-mail to your TA](#)

OK

Inorganic Chemistry

(Primary reviewer's copy)

- Required
- Send in-depth course material if you teach a course in this curricular area
- Syllabi must include a list of topics taught
- All exams and finals must be included and labeled with the school name, course name, course number, and year taught
- Materials must be from courses taught in the last two academic years
- Staple the entire packet together. Use only one staple.**

CHM 467 Advanced Inorganic Chemistry

1. **DOCUMENT TITLE:** COURSE SYLLABUS
2. **COURSE NUMBER/DESIGNATION/SECTION:** CHM 467.01
3. **COURSE TITLE:** Advanced Inorganic Chemistry
4. **CREDIT HOURS:** 3
5. **SEMESTER, YEAR:** Spring and ... is it "two thousand and eleven" or "twenty eleven?"
6. **LOCATION OF CLASS MEETING:** Sam Houston State University Campus, CFS 101
7. **MEETING TIMES:** 9:30-10:50 Tuesday, Thursday ... as always!
8. **OFFICE LOCATION:** CFS 304 ... lab location CFS 301
9. **OFFICE HOURS:** Initially W 3:00-4:50, TuTh 1:00-1:50
10. **OFFICE PHONE, E-MAIL ADDRESS, WEB-SITE, ETC.:** 294-1525, CHM_PAL@SHSU.EDU, www.shsu.edu/~chm_pal/
11. **COURSE DESCRIPTION**
Properties of atoms and ions, bonding theory and structure, acid-base theory, reactions of inorganic compounds, nonaqueous solvents, and coordination chemistry are studied. Emphasis is on the underlying theoretical concepts involved. Junior standing in Chemistry. Prerequisite: CHM 458 and firm understanding of CHM 138/139 and 238/239.
12. **COURSE OBJECTIVES**
Chemistry 467 is a culmination of chemistry courses taken over the first two or three years of an undergraduate curriculum thus the material covered in each course, to include, periodic properties of the elements, chemical reactivity of various classes of compounds, mechanisms of organic reactions, chemical thermodynamics, acid-base theories and bonding theories constitute required material in this course. The student will build on the success of an undergraduate program by mastering the principles and concepts associated with inorganic chemistry. The student will continue to develop his/her skills related to solving abstract problems in chemistry and applying chemical principles to enhance the understanding of the abstract world of atoms and molecules.
13. **TEXTBOOK(S) AND ALL REQUIRED SUPPLIES**
(1) Inorganic Chemistry, Miessler and Tarr, 3rd or 4th edition.
(2) Chemistry: The Central Science by Brown, Lemay, and Bursten, 8-11th Ed.
14. **COURSE REQUIREMENTS**
 - **Exams**
What type of questions should we expect on the tests? The exams will include short answer questions such as vocabulary or chemical reactivity as well as discussion questions which lend themselves to detailed essay responses. Each test will begin with a vocabulary section, a nomenclature section, and a chemical reaction section. Following these will be a short answer section which will require simple recall or association and then a long answer section in which the student will need to develop a comprehensive discussion, applying various principles or concepts to a difficult chemical problem.

- **Grading Plan**

How is my grade to be determined? Each exam will be graded by the instructor and this subjective evaluation will be converted to a numerical scale in which the A range is 99-90; the B range is 89-80; the C range is 79-70, the D range is 69-60 and the F range is <60. Because the format of the course is a discussion/seminar course the instructor will also evaluate the student's performance during each section with an assessment of how well the student appears to grasp the material and how much of a contribution the student makes to the groups' discussions.

The sum of the scaled grades can be correlated to the course grade:

Mid-term examinations (3)	=	300 pts	(Exam average => letter grade)
Final Exam	=	100 pts	
Service learning project	=	100 pts	
<u>Homework and class work</u>	=	<u>100 pts</u>	
Course Total	=	600 pts	(Course total => letter grade)

- **Assignments**

Notice that there are points associated with homework and in-class exercises. Homework will take two forms, one will be Blackboard graded multiple choice and the other will be "long answer" exercises, some of which will be end-of-chapter problems. The homework provides the necessary practice for the exams. These problems and questions will be discussed during class. The in-class exercises provide an active learning cycle as well as immediate feedback indicating contemporary preparedness.

All students are required to refer to their **Blackboard** section when they bring up the University Home Page (center; under academics). This section is in a registered **Blackboard** course and assignments, extra material and announcements will be made through this medium.

- **Attendance**

The Faculty Handbook provides that regular and punctual class attendance is expected of each student at Sam Houston State University and that it is expected that each faculty member will keep a record of student attendance. A student shall not be penalized for three or fewer hours of absences when examinations or other assigned class work have not been missed. Each instructor is obligated to clarify policy regarding absences in writing at the beginning of the semester and summer session.

- Excessive absences, tardiness, or leaving early will adversely affect the student's grade.
- There are no "excused absences" as attendance is a binary matter: present or absent.
- It is the student's responsibility to sit in the assigned seat if assigned seats have been given.
- It is the student's responsibility to register only his or her attendance. Failure to do so constitutes academic dishonestly.
- Students will be allowed three class hours of absence without penalty. Any absences over this will result in grade reduction in the course grade.
- Each student will attend class. The university allows a student to miss one week of class but holds the student responsible for the work done or assigned during the missed class(es). Class attendance is a binary function (Was I in class? "yes" or "no." Note that : "no, but I have an excuse..." means no you weren't in class. A excused absence does constitute an exemption.)
- The course grade will be lowered one-quarter letter grade for each absence over three class hours.
- Homework is due at the beginning of the designated time. Multiple page assignments **MUST** be stapled in the upper left hand corner. No late homework is accepted. (This is an organizational dictate...just look at my desk!) No comprehensive make-up will be given but the comprehensive fraction of the final will count twice iff an student has a passing grade on other exam.

- **Academic Honesty**

The Faculty Handbook states that the University expects all students to engage in all academic pursuits in a manner that is above reproach. Students are expected to maintain complete honesty and integrity in the academic experiences both in and out of the classroom. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. Furthermore, the University and its official representatives may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including, but not limited to, cheating on an examination or other academic work which is to be submitted, plagiarism, collusion and the abuse of resource materials.

If the faculty member or his official representative concludes that submitted academic work was totally or partially derived by dishonest means then that material will receive a zero grade and resubmission will be disallowed. At the time of the academically dishonest behavior, at the instructor's or his representative's discretion, the behavior shall be designated disruptive and the student will be asked to leave the class.

- **Proper Classroom Demeanor/Rules of Conduct**

Students will refrain from behavior in the classroom that intentionally or unintentionally disrupts the learning process and, thus, impedes the mission of the university. Please turn off or mute your cellular phone and/or pager before class begins. Students are prohibited from eating in class, using tobacco products, making offensive remarks, reading newspapers, sleeping, talking among each other at inappropriate times, wearing inappropriate clothing, or engaging in any other form of distraction. Inappropriate behavior in the classroom shall result in, minimally, a directive to leave class or being reported to the Dean of Students for disciplinary action in accordance with university policy. If a student is dismissed then that class period will be counted as an absence.

15. OTHER ADMINISTRATIVE MATTERS

- **Americans with Disabilities Act:** According to University policy, requests for accommodations must be initiated by the student. A student seeking accommodations should go to the Counseling Center and Services for Students with Disabilities (SSD) in a timely manner. Every semester that the student desires accommodations, it is the student's responsibility to complete a Classroom Accommodation Request Form at the SSD office and follow the stated procedure in notifying faculty. Accommodations for disabled students are decided based upon documentation and need on a case-by-case basis by the Counseling Center. The class instructor will support the center's directives.
- **Religious Holidays:** University policy states that a student who is absent from class for the observance of a religious holy day to take an examination or complete an assignment scheduled for that day within a reasonable time after the absence. The student, not later than the 15th calendar day after the first day of the semester, or the 7th calendar day after the first day of a summer session, must notify the instructor of each scheduled class that he/she would be absent for a religious holy day.

16. MISCELLANEOUS (AS NEEDED OR DESIRED)

- **Visitors in the Classroom**
None allowed.

17. COURSE OUTLINE

Week	Chapter (M&T)	Chapter (B&L, 9th)	Topic
1		2&4	Review of Freshman Chemistry Nomenclature & Reactions
2-3	3&5	6&7	Simple Bonding Quantum Chemistry
4-5	5	8&9	Molecular Orbital Theory The Covalent Bond
6-7	6	16	Acids - Base Chemistry Concept of "Strength" BLABT & Lewis-ABT & HS-ABT
8-9	9&10	24	Coordination Chemistry Bonding and Structure
10-11	12	24	Coordination Chemistry Kinetics & Mechanism
13-14	13&14		Organometallic Chemistry Bonding & Reactions

Organic Chemistry

(Primary reviewer's copy)

- Required
- Send in-depth course material if you teach a course in this curricular area
- Syllabi must include a list of topics taught.
- All exams and finals must be included and labeled with the school name, course name, course number, and year taught
- Materials must be from courses taught in the last two academic years
- Staple the entire packet together. Use only one staple.**

Chemistry 239 – Organic Chemistry II
Sam Houston State University
Spring 2011
Dr. Donovan C. Haines

Course Information

Section 01: MoWeFr 10:00 am - 10:50 am
Meet in CFS 123

Instructor Information

Dr. Donovan C. Haines
Office: CFS 317F Phone: 936-294-1530 Email: haines@shsu.edu
If I'm not in my office, try my lab CFS329 (near the top of the main stairwell)
Office hours (tentative – listen in class for any changes):
MoWeFr 11:00am-11:30am
TuTh 10:00am - 10:30 am
(other hours by appointment)

Required Materials

Textbook (required): Wade, "Organic Chemistry", 7th edition, Prentice Hall,
ISBN 9780321592316 or equivalent (you only need the textbook itself).

SHSU Catalog Descriptions and Prerequisites

- CHM 238 Organic Chemistry I: Lecture.** [CHEM 2323] A study of chemical bonding and structure of organic molecules is made. Functional group reactions and syntheses are emphasized. Reaction mechanisms, nomenclature and isomerism are studied.
Prerequisite: A minimum grade of C in CHM 138/118, 139/119. Fall, Spring, Summer I.
Credit 3.
- CHM 239 Organic Chemistry II: Lecture.** [CHEM 2325] The general plan of CHM 238 is continued. Fall, Spring, Summer II. Prerequisite: A minimum grade of C in CHM 238.
Credit 3.
- CHM 218 Organic Chemistry I: Laboratory.** [CHEM 2123] Laboratory for CHM 238.
Prerequisite: A minimum grade of C in CHM 119, and prior credit for or concurrent enrollment in CHM 238. Credit 1.
- CHM 219 Organic Chemistry II: Laboratory.** [CHEM 2125] Laboratory for CHM 239.
Prerequisite: A minimum grade of C in CHM 218, and prior credit for or concurrent enrollment in CHM 239. Credit 1.

Schedule (subject to change):

	Date	Chapter	Subject
Wed	1/19	1-9, 12-13	Intro and Org I Review
Fri	1/21	10	Importance of pKa; Structure and Synthesis of Alcohols
Mon	1/24	10	Structure and Synthesis of Alcohols
Wed	1/27	10	Structure and Synthesis of Alcohols
Fri	1/28	10	Structure and Synthesis of Alcohols
Mon	1/31	11	Reactions of Alcohols
Wed	2/3	11	Reactions of Alcohols
Fri	2/4	11	Reactions of Alcohols
Mon	2/7	EXAM	Exam 1 (Review Chpaters (1-11), Chapters 10-11)
Wed	2/10	14	Ethers, Epoxides, and Sulfides
Fri	2/11	14	Ethers, Epoxides, and Sulfides
Mon	2/14	15	Conjugation, Orbitals, and UV-vis
Wed	2/17	15	Conjugation, Orbitals, and UV-vis
Fri	2/18	15	Conjugation, Orbitals, and UV-vis
Mon	2/21	16	Aromaticity
Wed	2/24	16	Aromaticity
Fri	2/25	16	Aromaticity
Mon	2/28	EXAM	Exam 2 (Chapters 14,15,16)
Wed	3/3	17	Reactions of Aromatics
Fri	3/4	17	Reactions of Aromatics
Mon	3/7	17	Reactions of Aromatics
Wed	3/10	18	Aldehydes and Ketones
Fri	3/11	18	Aldehydes and Ketones
Mon	3/14		SPRING BREAK
Wed	3/17		SPRING BREAK
Fri	3/18		SPRING BREAK
Mon	3/21	19	Amines
Wed	3/24	19	Amines
Fri	3/25	19	Amines
Mon	3/28	EXAM	Exam 3 (Chapters 17,18,19)
Wed	3/31	20	Carboxylic Acids
Fri	4/1	20	Carboxylic Acids
Mon	4/4	21	Carboxylic Acid Derivatives
Wed	4/7	21	Carboxylic Acid Derivatives
Fri	4/8	21	Carboxylic Acid Derivatives
Mon	4/11	EXAM	Exam 4 (Chapters 20,21)
Wed	4/14	22	Enolates
Fri	4/15	22	Enolates
Mon	4/18	22	Enolates
Wed	4/21	26	Polymers
Fri	4/22	HOLIDAY	Good Friday Holiday
Mon	4/25	26	Polymers
Wed	4/28	26	Polymers
Fri	4/29		Integration and Review
Mon	5/2	EXAM	Exam 5 (Chapters 22,26)
Wed	5/5		Integration and Review
Fri	5/6		Integration and Review
Monday	5/9	11:00am	COMPREHENSIVE FINAL EXAM (ACS)

Note on Learning Strategies:

Many students start out trying to memorize all the reactions in this course. Memorization is a necessary part of studying organic chemistry, and most students find flash cards helpful in this regard. A common mistake, however, is thinking memorization is the major way you should study. You will be presented with far too many reactions to memorize, but they will all occur through only a few common mechanisms. Learn those mechanisms and the fundamentals of what causes something to be reactive and you will do much better. Understanding mechanism is the key managing this course. Remember, *Organic Chemistry is the behavioral psychology of electrons*. Learn what the electrons want to do and why and you have it made.

Your major goal should be to learn to predict what chemistry can happen even for reactions that you have not seen before. That comes from an understanding of chemistry.

My best advice is to treat this course like a math course – you learn by working problems and practicing. Your textbook gives you a lot of problems to practice with, and there is no problem there that will not teach you something. Work as many as you possibly can! We will focus a lot on reaction mechanisms. You will need to memorize a lot of reactions and their characteristics (stereospecificity for example) – an organic chemist's toolbox needs to be filled with all of the appropriate tools for building a wide variety of molecules. But in practicing the application of those tools by working problems and analyzing spectra you gain the experience it takes to truly understand chemistry.

You should be working the problems in the text daily (see Problem Solving Notebook for required problems). Both quizzes and exams may include questions from the text from time to time. Keep in mind also that your responsibility is to learn anything presented in your text in the chapters we cover. I won't go through it all in lecture, I will use that time to go through sample reactions to demonstrate the major concepts and the especially tricky concepts.

This is a very difficult course, there is no doubt about that. Your goal should not be to pass; it should be to excel. Once you are beyond this step of your career progression, you will find yourself often compared to others (in a pool of applicants for a job or for medical school for example) who all also passed this course. In my experience, your abilities in organic chemistry are used by people to judge your abilities in chemistry in general; make sure your understanding of organic chemistry (including but certainly not limited to your grade in this course) puts you at the top of the list of applicants, not the bottom. For those of you who wish to be practicing chemists someday, it is obviously essential to master organic chemistry. For those of you interested in the chemistry of living things (future biologists, biochemists, toxicologists/forensics scientists, pharmacists, doctors, PAs, nurses, veterinarians, nutritionists, environmentalists etc.) a good fundamental understanding of organic chemistry will pay you back 10-fold when you start studying proteins, vitamins, metabolism, and pharmaceuticals (I say that as someone who has taught those subjects for nearly a decade now).

Grading

Short Paper	5%
Problem Solving Notebook	10%
Quiz Average (lowest 1/5 th will drop)	15%
Exams (Average of 5)	50%
Final Exam (ACS standardized exam)	20%

Your total points for the semester will be rounded to the nearest whole point and your grade will be determined as follows:

90% and above	A
80% to 90%	B
70% to 80%	C
60% to 70%	D
Below 60%	F

Quizzes. For each quiz the instructor will, without prior announcement in most cases, require that it be taken in class, as a take-home assignment, or online on Blackboard. Missed quizzes carry a grade of 0, there are no makeup quizzes. Quizzes will generally focus on material covered in the lecture or two prior to the quiz, but are comprehensive and may cover any material discussed up to that point in the semester. Both exams and quizzes may cover, in addition to lecture material, any subject covered in the text that Dr. Haines does not specifically rule out.

Exams. Exams will be taken during normal class time. There are no makeup exams, if you miss an exam (for one exam only) you may replace that score with your score on the comprehensive final. All exams are inherently comprehensive, but focus on the material covered since the previous exam. *You will need to bring a green scantron (Form No. 882-E; 50 questions on each side) to each exam including the Final Exam.* Exams typically include a multiple choice section and a written section, except for the standardized final which is completely multiple choice.

Problem Solving Notebook. You will be required to keep a notebook where you write out problems you work as practice during the semester. From time to time (typically Mondays) Dr. Haines will collect them and grade how well you've done keeping up with the problem solving practice. The average of these grades counts 10% of the overall course grade.

Short Paper. You will be required to write a short paper on a subject pertinent to Organic Chemistry (describing a pharmaceutical or type of plastic, for example), the details of which (including due date) will be handed out in class by the end of the first full week of class.

Final Exam. We use a standardized exam produced by the American Chemical Society covering all of Organic Chemistry (Organic I + II). Note that ACS does also sell a study guide for Organic Chemistry. In my opinion it is primarily useful as a general review of the course, not as a specific review for our exam, but if you wish to check it out you can find the information here: http://www4.uwm.edu/chemexams/guides/details_guides.cfm?ID=163.

Blackboard:

We will use Blackboard heavily for this course. You will find PowerPoint files and printable lecture note handouts there, check grades, and take some quizzes in Blackboard. In addition, some writing assignments will be uploaded or pasted directly into Blackboard. You must check both Blackboard and your email periodically (at least once or twice per week) for announcements.

Tegrity:

Dr. Haines will be using Tegrity to record lectures and for some assignments outside of lecture. Tegrity is a program that SHSU subscribes to that will record everything on the screen and the audio on a microphone that Dr. Haines uses in class. Typically lectures are available (from within Blackboard on the Tegrity Campus tab) within an hour or two after lecture. The Tegrity program will compress the audio, let you play back the presentation on your computer, indexes the presentation so you search for text on the powerpoint slides and find that spot in the video, let you download the video or MP3, subscribe as a PODcast, and many other useful things. Your access is all through a webpage that is linked to within Blackboard. Students have found this extremely useful and I will require you to check it out early in the semester. Like any technology, however, from time to time there is a malfunction so *it is possible that not all lectures may be available*. If you have problems accessing it from off campus you can always use the on campus computer labs (in LSC for example). As Dr. Haines tests related tools, he may post additional audiovisual learning aids as well.

Problem Notebook

Your problem notebook should have your name and "CHM 239" written somewhere on the front cover (preferably near the top right corner). Problem numbers should be clearly marked, with the chapter number and the problem number both presented (for the first problem, for example, '10-1'. You don't have to use pen, in fact pencil is recommended. Erasing mistakes is fine, it is a normal part of this kind of problem solving. As you can see there are a lot of problems, you will want a notebook with a lot of pages. If you do fill a notebook, you can start another.

Typically notebooks will be collected on Monday and returned on Wednesday. Each Monday you should have all problems finished from any chapters we have finished in class (see schedule of chapters). This usually means a different chapter each week. Note that a majority of the problems assigned are within the chapters themselves, and demonstrate the concepts of each section; I recommend that you work these as you read the chapter. If you work problems while Dr. Haines has your notebook grading it, you may work them on paper and staple them to the next blank pages in your notebook when it is returned to you. You may **not** affix photocopies, only original handwritten work.

<u>Chapter</u>	<u>Problems to Work</u>
10	1-30, 34, 35, 38, 39, 42, 45, 47, 49
11	1-38, 42, 45, 46, 52, 59
14	1-28, 34, 38, 39, 40, 42, 46, 47
15	1-22, 24, 25, 26, 31, 32, 33
16	16-25, 28, 30, 31, 32, 37, 38, 45, 46, 49
17	1-42, 49, 50, 55, 60
18	1-38, 42, 43, 44, 47, 48, 52, 57, 60, 64, 66, 72, 73, 74
19	1-34, 38, 40, 43, 53, 56, 58, 62
20	1-24, 26, 36, 38, 40, 45, 50
21	1-42, 45, 48, 51, 55, 58, 59, 62, 64, 65, 66, 67
22	1-59, 62, 70, 71, 75, 77
26	1-20, 23, 24, 25, 26, 27, 28, 31

University Wide Policies

Additional details can be found at <http://www.shsu.edu/syllabus/>.

ACADEMIC DISHONESTY:

All students are expected to engage in all academic pursuits in a manner that is above reproach. Students are expected to maintain honesty and integrity in the academic experiences both in and out of the classroom. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. The University and its official representatives may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including but not limited to, cheating on an examination or other academic work which is to be submitted, plagiarism, collusion and the abuse of resource materials. For a complete listing of the university policy, see:

<http://www.shsu.edu/administrative/faculty/sectionb.html#dishonesty>

STUDENT ABSENCES ON RELIGIOUS HOLY DAYS POLICY:

Section 51.911(b) of the Texas Education Code requires that an institution of higher education excuse a student from attending classes or other required activities, including examinations, for the observance of a religious holy day, including travel for that purpose. Section 51.911 (a) (2) defines a religious holy day as: "a holy day observed by a religion whose places of worship are exempt from property taxation under Section 11.20...." A student whose absence is excused under this subsection may not be penalized for that absence and shall be allowed to take an examination or complete an assignment from which the student is excused within a reasonable time after the absence.

University policy 861001 provides the procedures to be followed by the student and instructor. A student desiring to absent himself/herself from a scheduled class in order to observe (a) religious holy day(s) shall present to each instructor involved a written statement concerning the religious holy day(s). The instructor will complete a form notifying the student of a reasonable timeframe in which the missed assignments and/or examinations are to be completed. For a complete listing of the university policy, see:

<http://www.shsu.edu/~vaf/www/aps/documents/861001.pdf>

STUDENTS WITH DISABILITIES POLICY:

It is the policy of Sam Houston State University that individuals otherwise qualified shall not be excluded, solely by reason of their disability, from participation in any academic program of the university. Further, they shall not be denied the benefits of these programs nor shall they be subjected to discrimination. Students with disabilities that might affect their academic performance are expected to visit with the Office of Services for Students with Disabilities located in the Counseling Center. They should then make arrangements with their individual instructors so that appropriate strategies can be considered and helpful procedures can be developed to ensure that participation and achievement opportunities are not impaired.

SHSU adheres to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations for students with disabilities. If you have a disability that may affect adversely your work in this class, then I encourage you to register with the SHSU Counseling Center and to talk with me about how I can best help you. All disclosures of disabilities will be kept strictly confidential. NOTE: No accommodation can be made until you register with the Counseling Center. For a complete listing of the university policy, see:

<http://www.shsu.edu/~vaf/www/aps/811006.pdf>

VISITORS IN THE CLASSROOM:

Only registered students may attend class. Exceptions can be made on a case-by-case basis by the professor. In all cases, visitors must not present a disruption to the class by their attendance. Students wishing to audit a class must apply to do so through the Registrar's Office.

CHM239 – Dr. Haines

Short Paper Requirements

Due Date (Spring 2011): Friday, April 29th

You are to research and write a two page paper on a topic relevant to organic chemistry (topic suggestions attached) that you find interesting. In my experience, picking a personally relevant topic (i.e. prescription drug you or a loved one has taken, vitamins, picking a chemist from this part of Texas (Smalley for example)) works the best.

The text of the paper should be typed, single spaced, with 1" margins. There should be a title page with the title and your name, and at least two pages of typed single-spaced text in no larger than 12 point font (Times or equivalent).

Figures and Tables should be numbered, include written captions, and be attached after the text. They should be referred to by number (i.e. 'Figure 1') when discussed in the text.

References should be identified with superscript numbers in the text referring to a numbered list of references given after the main text. Information in Wikipedia is useful but should not be your main reference for this assignment. Although any standard format for the references can be used as long as they are listed in the order cited, a good format to follow is the American Chemistry Society style guide, which can be found here (or look in a copy of the Journal of the American Chemical Society in the library):

<http://pubs.acs.org/uscrimages/ContentEditor/1246030496632/chapter14.pdf>

The paper is required to include the following:

1. It must mention at least one chemist by name and (if not deceased) their current university, institute, or company.
2. You must have references as mentioned above, numbered in the order they appear in the text. At least one reference should not be an internet source (should be a book or a literature article).
3. You must have at least one figure with a hand drawn chemical mechanism relevant to your topic. All formal charges and lone pairs of electrons should be shown on the appropriate atoms. (Note: it must be *hand drawn* – no copying figures). (Also note: if you have a topic you like but can't think of an appropriate reaction mechanism, ask Dr. Haines; he is good at suggesting relevant reactions.)

You will be required to **both** 1) upload the text portion of the paper to blackboard and 2) turn in a copy of the paper with figures to Dr. Haines in class. Blackboard will check for plagiarism, so make sure you write your paper yourself! Don't copy and paste from your sources, the words should be your own.

Potential topics (these are just suggestions; you are not limited to this list):

- Focus on a compound an organic chemist might synthesize or study (see also reagents in the next section)

Some examples (you are not limited to these):

- Buckminsterfullerene, carbon nanotubes, graphite
- Conducting polymers (plastics that conduct electricity)
- Detergents
- Epoxy glues
- Hormones/neurotransmitters (adrenaline, dopamine, estrogen, testosterone, hydrocortisone, thyroid hormone, progestins, etc.)
- Pharmaceutical drugs (Taxol, Prozac, aspirin, statins, codeine, ketoconazole, etc.)
- Rubber (various treatments, etc.)
- Teflon
- Traditional polymers (polystyrene, polyethylene (PET), polypropylene)
- Vitamin C, riboflavin, niacin, or other vitamins

- Focus on a reaction, reagent, group, or solvent

Some examples (you are not limited to these):

- 'click chemistry', azide alkyne Huisgen cycloaddition
- A protecting group: benzoyl, TMS, Boc, Tips, Ts, Cbz, acetals
- Acetonitrile
- Aldol Condensation, Dieckmann Condensation, Claisen Condensation
- Baeyer-Villiger Oxidation
- Birch Reduction
- Carbodiimide couplings (dicyclohexylcarbodiimide and EDC)
- Chloroform; methylene chloride
- Diels Alder
- Diethyl ether; petroleum ether
- Dimethylaminopyridine; pyridine
- Dimethylformamide
- Friedel Crafts Alkylation or Acylation
- Gabriel Synthesis
- Grignard Reaction
- Heck Reaction
- Hofmann Rearrangement
- Jones Oxidation
- Michael Addition
- Mitsunobu Reaction
- Pyridinium chlorochromate, PDC, etc.
- Sharpless asymmetric dihydroxylation
- Stille Coupling
- Swern Oxidation
- Toluene
- Wittig Olefination
- Wolf-Kishner Reduction

- Focus on a chemist

Some examples (you are not limited to these):

- Alan McDiarmid (conducting polymers)
- Allen Bard (electrochemistry/nanochemistry/imaging)
- August Kekulé (chemical structure)
- Barry Sharpless (stereoselective organic synthesis)
- Benjamin Cravatt (chemical biology)
- Carolyn Bertozzi (medicinal chemistry; contact lens chemistry)
- Elias Corey (retrosynthetic analysis, PCC, protecting groups)
- Frank 'Al' Cotton (transition metal chemistry)
- George Olah (carbocations/superacids)
- George Whitesides (Nanochemistry, self-assembly, organometallics)
- Gilbert Stork (organic synthesis)
- Henry Eyring (reaction rates)
- Herbert Gutowsky (NMR)
- Hermann Staudinger (polymers; biopolymers)
- J. Fraser Stoddart (host/guest chemistry; molecular machines)
- John Pople (computational chemistry)
- Kurt Alder (synthetic rubber; Diels Alder)
- M. Frederick Hawthorne (Boron chemistry)
- M. Katharine Holloway (HIV drug development)
- Mary Fieser (Steroid hormone and vitamin synthesis and structure determination)
- Paul Anderson (pharmaceutical/medicinal chemistry)
- Peter Schultz (catalysis by proteins)
- Richard Ernst (NMR and MRI)
- Richard Lerner (catalyzing organic chemistry with antibodies)
- Richard Smalley (Bucky balls; carbon allotropes)
- Richard Zare (laser chemistry; astrobiology/biochemistry)
- Robert Merrifield (solid-phase synthesis of peptides)
- Ruth Benerito (chemical treatment of fabric; 'wash and wear')
- Samuel Danishefsky (natural product synthesis (Taxol etc), drug discovery)
- Sir Derek Barton (conformations of organic molecules; organic synthesis)
- Sir William Henry Perkin (aniline dyes)
- Stuart Schriber (chemical biology)

CHM239 Organic Chemistry II

Haines, Spring 2010

The final exam was the ACS Division of
Chemical Education Examination on
Organic Chemistry (the full year exam),
form 2008

Physical Chemistry

(Primary reviewer's copy)

- Required
- Send in-depth course material if you teach a course in this curricular area
- Syllabi must include a list of topics taught
- All exams and finals must be included and labeled with the school name, course name, course number, and year taught
- Materials must be from courses taught in the last two academic years
- Staple the entire packet together. Use only one staple.**

SAM HOUSTON STATE UNIVERSITY

SPRING 2011

COURSE SYLLABUS CHM 449 (LECTURE & LABORATORY) PHYSICAL CHEMISTRY II 4 CREDIT HOURS

Professor: Dr. Darren L. Williams

Daily office hour: M-F, 10 AM, all other times by appointment via Williams@shsu.edu.

Phone: (936)294-1529; Fax (936)294-4996; Office: CFS 317G; Lab: CFS 235

1. Course Description

This course will cover thermochemistry, the laws of thermodynamics, phase equilibria, and kinetics. A minimum grade of C in CHM 448 is the prerequisite. The four-hour course consists of 3 hours of lecture and four hours of lab work per week.

2. Course Objectives

The main course objectives are:

- IDEA Objective #2: To learn fundamental principles, generalizations, and theories.
- IDEA Objective #4: To develop specific skills, competencies, and points of view needed by professionals in the field of Chemistry.

3. Enabling Objectives

The following objectives will enable the student to achieve the course objectives.

- Explore the quantum roots of thermodynamics (Chapters 29[12]-32[15])
- Master the applications of thermochemistry and thermodynamic cycles (Chapters 1-6)
- Describe the properties of real solutions and materials (Chapters 7-11).
- Describe the basics of non-equilibrium systems (Chapters 33[16]-34[17])
- Perform laboratory experiments and measurements related to the course material.
- Use computational chemistry programs to predict and confirm course principles.
- Use Microsoft Excel for numerical integration, multiple least-squares regression, Boolean logic operators, and non-linear equation modeling.

4. Required Textbooks

- Required: Physical Chemistry, 2nd Ed. by Thomas Engel and Philip Reid, Pearson Benjamin Cummings, (ISBN: 0-321-61505-0) OR Thermodynamics, Statistical Thermodynamics, and Kinetics, 2nd Ed. by Thomas Engel and Philip Reid, Pearson Benjamin Cummings, (ISBN: 0-8053-3844-6)

5. Grading Policy

- To determine the final course grade, the student's numerical average will be compared to course requirements, to peer performance, and to the definitions set forth in the University Catalog. Specific grade cut-off values are not predetermined.
- Students taking this course for graduate credit will be required to prepare an additional report that incorporates various facets of the course into one advanced problem. This report will constitute an additional 10% towards the final grade average. This results in the following weighting factors: Attendance = 5% Homework = 5%, Laboratory = 10%, Exams = 70%, Final Report = 10%.

Category	Weight
Attendance	5%
Homework	5%
Laboratory	10%
Exams	80%

6. Attendance Policy

- Students will not be penalized for missing up to three hours of lecture as long as examinations and other assigned work have not been missed.
- Each absence above 3 will result in a loss of 1/5th of the attendance grade.
- Laboratory attendance is mandatory. If unavoidable conflicts arise, then arrangements should be made in advance by the student. The schedules of the TA and the professor take precedence over the schedule of the student (including work schedules) when making arrangements for makeups.
- An unannounced and unaddressed laboratory absence will yield a failing grade.

7 Homework Assignments

- Homework assessment will take place on Blackboard
 - Print the pdf of the homework assignment. Do the problems, and then enter your answers on Blackboard. You only get TWO ATTEMPTS to enter your answers, so take it seriously. Don't procrastinate..
 - Most of the exam material will come from modified Blackboard homework problems.
 - Approximately 10% of the exam will come from the suggested "A-level" problems or lab work.
- It is up to the student to check their grades on the Blackboard system.
 - Early in each section of material, if you mess up on Blackboard and get a lock in the gradebook, email Dr. Williams as soon as possible to reset the attempt.
 - Do not procrastinate and lock up your 1st attempt the night before it is due. **You will get a zero.** You have two attempts, so use one early to ensure you have a non-zero grade.
- Assignments are due **BEFORE CLASS ON THE DUE DATE**. Late work can be refused, but reasonable accommodations can be made for students who experience unfortunate circumstances. Late assignments will be considered for acceptance only if all the following conditions are met:
 - The student was demonstrably incapacitated on the due date or Blackboard was **REPORTED BY COMPUTER SERVICES** as being down on the due date. Remote computer problems are not acceptable excuses. The computer labs on campus are the most reliable way to complete the homework assignments.
 - The student telephoned in advance or left a voice mail message or email message alerting DW to their situation with a description of why they are to miss the due date for the assignment. (All information will be kept in strict confidence.)
- The gradebook in Blackboard will be updated after each exam. At that time, Dr. Williams will change all gradebook locks to ZEROs.

8. Laboratory Work

- The laboratory experiments and the requirements for laboratory reports will appear on Blackboard as the semester progresses.
- Lab work will feed directly into the exams in both the multiple-choice sections and the open-ended questions. **Success on the exams requires full effort on the laboratory portion of the course.**
- Sometimes oral instructions and modifications are given in class. These are binding, and detailed notes of what is said in class are required for success.
- The top priority for laboratory work is **SAFETY!**
 - Safety glasses or goggles **MUST** be worn at all times in the physical chemistry laboratory.
 - If the actions of any student are deemed to be unsafe and hazardous to themselves, their peers, or the well-being of the facilities, the student will be removed from the laboratory, and an appointment will be made with the department chair to evaluate a course of action.
- Students should not be in the laboratory if they are not working on their experiment. Visitors to the laboratory are prohibited unless escorted by departmental personnel. If a student needs to meet with others who are not registered in the course they must leave the laboratory.

9. Exams

- Exams will utilize a Scantron form 882-E
- The final exam week is May 10 – 14th and **you should not** make travel plans until the 15th!
- There will be multiple midterm exams and a comprehensive final exam.
- Exams will be announced in class, and an announcement will be posted on Blackboard stating what the exam will cover.
- The exam answer sheets will remain the property of SHSU as a record of student performance.
- Make-up examinations are not given. In the unfortunate case, where a student misses an exam, the professor will discuss possible remedies with the student provided that all the following conditions are met:
 - The student was absent on the exam date.

- The student telephoned in advance or left a voice mail message or email message alerting the professor to their absence along with a description of why they are to miss the exam. (All information will be kept in strict confidence.)
- The professor also reserves the right to assign an exam grade of 0% if the absence was not properly handled or was unjustified. Appeals will be handled in accord with University Policy Statement 900823, Academic Grievance Procedures for Students.
- The final comprehensive examination will be averaged with the midterm exams to determine the total exam average.

10. Academic Dishonesty

- If it is obvious that a homework assignment or laboratory report is a copy of another student's work, BOTH copies will receive a grade of 0%, and BOTH students will be on notice that they will be reported for scholastic dishonesty should they be involved in any questionable work in the future.
- Dr. Williams reserves the right to ask for an oral explanation of work submitted to determine if the student actually performed the work. This should not be construed as an accusation of academic dishonesty. It is merely a tool to ensure that students are able to explain their work to their supervisors. Only in cases where the student cannot demonstrate the most basic explanation of what they submitted as their original work will there be suggestion of dishonesty.
- The University may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including, but not limited to, cheating on an examination or other academic work which is to be submitted, plagiarism, collusion, and the abuse of resource materials. *This includes PAST 449 students. Do not accept previous lab reports if they are offered! This puts you both at risk of academic discipline.*

11. Classroom Rules of Conduct

- Cell phones must be turned off before class.
- Students who are especially disruptive may be reported to the Dean of Students for disciplinary action in accordance with university policy.

12. Visitor Policy

Dr. Williams will decide whether or not the visitors will be allowed to remain in class.

13. Instructor Evaluation

- The IDEA system asks the student to evaluate their performance towards the course objectives.

14. Americans with Disabilities Act

No accommodation can be made until the student registers with the Counseling Center.

15. Religious Holidays

Dr. Williams will comply with university policy and state law regarding religious holidays.

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SAM HOUSTON STATE UNIVERSITY

Topic List for CHM 449
Physical Chemistry II
Spring 2011

Quantum Roots of Thermodynamics

- Probability, Statistics, and Distribution Functions
- Boltzmann Distribution Properties
- Partition Function Modeling, Approximation, and Temperature Dependence
- Statistical Thermodynamics

Thermochemistry and Thermodynamic Cycles

- Fundamental Concepts of Thermodynamic Models and Measurements
- The First Law
- State Function Properties
- Thermochemistry Calculations and Tabular Values
- Second and Third Laws
- Simple Ideal and Real Heat Engines
- Chemical Equilibrium Relationships

Phases and Phase Diagrams

- The Properties of Real Gases
- Phase Diagrams of Pure Substances, Binary Mixtures, and Miscibility
- Ideal and Real Solutions and Phase Behavior
- Electrolyte Solutions and Activity Coefficients

Nonequilibrium Thermodynamics

- Kinetic Theory of Gases
- The Transport Phenomena of Thermal Conductivity, Viscosity, Diffusion,

Sedimentation, Ionic Conductivity

Energy Sources and Sinks

- Thermochemistry and Combustion Sources of Energy
- Electrochemistry and Electrical Generation and Storage of Energy
- Nuclear Chemistry and Nuclear Power

Course Syllabus
 Chemistry 426.01
 Advanced Integrated Laboratory
 2 Credit Hours
 Spring 2011

(The Student Acknowledgement Form at the end of the syllabus must be completed, signed, and turned in to the Instructor by Jan 20, 2011)

Instructor:	Dr. Benny E. Arney	Semester:	Spring 2011
Classroom	CFS 313	Class Time	TuTh 1:00-4:50 PM
Office Phone:	294-1531 off-camp ext. 41531 on-camp	Email:	CHM_BEA@SHSU.EDU
Office:	CFS-326, CFS 305	Office Hours:	MTWTh: 9:30-10:50 AM

Course Description:

This course will involve in-depth experiments that require the use of sophisticated synthetic and analytical procedures in areas of organic, inorganic, and analytical chemistry. The first hour of the Monday Lab-day will be devoted to lecture over topics relevant to the lab and/or problem sets.

Prerequisites: CHM 448 with a grade of C or higher. Competence in the use of MS-Word, MS-Excel, and chemical structure software (ChemWindows).

This is a senior capstone laboratory course based on the students' need to integrate prior laboratory and lecture experience in order to successfully complete and report on a set number of laboratory experiments while working independently. Generally 4-8 hr of work and study outside of lab are required for each week of laboratory.

Course Objectives: To provide the students with hands-on experience utilizing a more advanced level of experiments. This is considered an opportunity for the students to utilize and apply the theoretical models and concepts of their didactic education in reports and discussions of the significance of their laboratory. Pursuing experiments and interpretations beyond the obvious are, **with supervision**, encouraged and expected.

Required Textbooks:

Your textbooks from your Freshman Chemistry, Organic, Analytical, Physical, and Inorganic Lecture and Laboratory Courses.

Required Supplies:

Department approved Lab Goggles, Lab Notebook that produces duplicate copies, Dish-detergent, non-erasable ink pens, a Sharpie marker.

Attendance Policy:

As this course is a performance-based course, the student must attend sufficient meetings of laboratory to conduct the experiments and collect the data and thus at least once a week is required. Students must work individually, with the single exception of the nickel glycinate experiment where they may work in pairs. Each time you attend lab you are required to sign-in.

Assignments:

There are three grade generating components for this course.

1. Professionalism and Attitude: The student's total grade points from the reports may be reduced by increments determined by their preparation and ability to work undirected in the laboratory. (See discussion below: Professionalism and Attitude)

2. Laboratory Reports: Each (6) report is worth 16 points each for a total of 96 points. (See discussion below: Lab Reports)

Grading Plan:

The final grade will be determined by the sum of the four (4) components.

Total Points = Prof&Att + Reports

A ≥ 86

B ≥ 77

C ≥ 67

D ≥ 57

Grades will be given back to each student (during class time only) for turned in assignments. Reports will not be returned but may be viewed after grading during office hours or by appointment.

A request for a regrade of an assignment must be submitted in writing within one week of receiving the returned grade. The request must state specific reasons for the regrade.

Sample Acceptable Reasons for Regrade requests:

- a. Arithmetic Error: Miscalculation of grade.
- b. Grader Overlooked material: loss of points for missing something that was present.

Sample Unacceptable Reasons for Regrade requests:

- a. Someone else got a higher grade.
- b. Got the "right" answer, but did not show work.
- c. Forgot to include

NOTE: If you disagree with the grading of a question, etc. because of conflicting textual information bring it to Dr. Arney's attention. Do not use the internet as a resource.

Academic Dishonesty:

All students are expected to engage in all academic pursuits in a manner that is above reproach. Students are expected to maintain complete honesty and integrity in academic experiences both in and out of the classroom. Any student found guilty of dishonesty (by

the professor) in any phase of academic work will be subject to disciplinary action. The University and its official representatives may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including, but not limited to, cheating on an examination or other academic work which is to be submitted, plagiarism, collusion and abuse of resource material.

Laboratory Rules of Conduct:

Students will refrain from behavior in the laboratory that intentionally or unintentionally disrupts the learning process and the mission of the university.

1. Approved laboratory goggles must be worn by the student at **ALL** times in the laboratory.
 2. No shorts, open shoes, loose-long hair, dangerously loose clothing will be allowed in the laboratory.
 3. All containers used must be reclosed immediately.
 4. No unauthorized or unapproved work may be performed in the laboratory.
 5. Cell phones and pagers must be turned off or set to silent before class begins.
 6. The laboratory is not for individual instruction, tutoring, or addressing questions about a particular grade. These types of interactions should be addressed during office hours or by appointment. It is disruptive and a waste of the other students' time and efforts to do this in lab. The use of new apparatuses will be demonstrated as deemed necessary by the instructor.
 7. Student may not do the following in Lab.
 - a. Eat.
 - b. Use tobacco products.
 - c. Use offensive, disruptive or obscene language or remarks.
 - d. Read newspapers or non-class related materials.
 - e. Socialize about unrelated matters.
 - f. Engage in distractive behavior.
 - g. Wear distractive clothing.
 8. Each student is expected to be prepared to start working when they arrive in lab.
 9. Horseplay will not be tolerated (See Professionalism and Attitude).
 10. The work area, balances, and equipment must be kept clean and functional.
 11. Carelessness and/or abuse of equipment and material will not be tolerated (See Professionalism and Attitude).
- Students engaging in inappropriate behavior or being especially disruptive shall be directed to leave the classroom. Students who are excessively or especially disruptive also may be reported to the Dean of Students for disciplinary action in accordance with university policy.

Visitors to the Classroom:

Unannounced visitors may not enter the laboratory and must present a current, official SHSU identification card to be permitted to remain just out of the laboratory. They must not present a disruption to the class by their attendance. If the visitor is not a registered student, it is the instructor's discretion whether or not the visitor will be allowed to remain.

Professionalism and Attitude:

As this is a senior level laboratory, seriousness, maturity, preparation, and self-initiative are not only hoped for, but is also expected in each student. Each student is expected to be

prepared to perform their chosen experiment whenever they show up for lab. In order to provide an incentive for the students to achieve these elements of behavior, adjustments for unacceptable behaviors will be made to the final point total for the semester. An exhaustive list is impractical but a few examples may help. Any such adjustment will be discussed with the student, but clearly dangerous activities will be acted upon. **Remember these points are deducted from the final total points.**

Examples:

- 1 pt – leaving work area messy or littered.
- 1 pt – leaving balance dirty.
- 1 pt – leaving reagent bottles open.
- 1 pt – not labeling every flask, beaker, etc. in use.
- 5 pt – not coming prepared for the work.
- 5 pt – not notifying the TA or Instructor of a spill.
- 5 pt – leaving a reaction unattended.
- 5 pt – leaving glassware dirty.

Dangerous activities, unauthorized experiments, stealing materials or equipment from the lab or performing experiments in a manner that endangers others can, at the discretion of the instructor, lead to automatic failure of the course without regard to points already earned.

Laboratory Reports:

Each experiment requires a report. Each report must be printed using a word processor, graphs, charts, structures, etc. must be produced using the appropriate software available on the university system. The format for each report will be given in a separate handout which lists the experiments and their sources.

Course Format : Each student is expected to complete 6 (six) experiments and turn-in a report for each. The report for each experiment is to be in the format of the indicated on the CHM426 Experiments Handout. Attached to each report will be the raw collected data in the form of the duplicate sheets from your laboratory notebook.

ADVISE:

- (1). It is to your advantage to attempt perform two or more experiments concurrently as most will have significant waiting periods which could be utilized for other experiments and work-ups.
- (2). Prior to lab you must obtain an acceptable procedure for the experiment, from the indicated sources, and prepare to perform the experiment by studying and understanding the operations involved and the nature and handling of the materials to be used.
- (3). The multi-step synthesis is best started as early as possible and run concurrently with other experiments.
- (4). You will not be "*prepped*" for each lab but an overview of the theory and application of new techniques and concepts will be covered in a weekly hour-long lecture/discussion. You are responsible for procuring the appropriate procedures and knowing the proper use of equipment. However, potentially

hazardous operations will be closely monitored by the TA/Instructor and NEW procedures, such as vacuum distillations will be discussed and demonstrated.

(5). The T.A.'s primary function in the laboratory is for safety and to provide the necessary material and equipment. The T.A. is not a source of information on the performance of the experiment.

LAB SAFETY: You are required to provide and wear at ALL TIMES in the laboratory, a pair of safety goggles and we strongly recommend a lab coat or apron. You should wear full-length pants or floor-length skirts (dresses) with closed shoes.

NO SHORTS,
NO TIES,
NO SUNGLASSES,
NO CELL-PHONES,
NO OPEN-TOED SHOES,
NO UNAUTHORIZED EXPERIMENTING, AND
NO EATING OR DRINKING OR USE OF TABACCO IN THE
LABORATORY.

Student Acknowledgement of Syllabus:

I, _____ (your name) having
SHSU ID# _____, have printed the syllabus for CHM 426.01 (Spring 2009).
I further acknowledge that I have read said syllabus and that I am familiar with its contents. I
also recognize that my continuance in this course requires that I agree to its content and
requirements and that changes to this syllabus are only possible if they further the aims of the
course.

I am also aware that questions and/or problems with the course must be addressed to the
instructor. If these problems are not part of the day's scheduled material, it should be addressed
after class, during office hours, or by appointment.

I acknowledge that I am aware of the following:

NO eating, drinking, or tobacco use in the laboratory.

No use of cell phones, or other none lab electronics in the laboratory.

No leaving heated apparatuses unattended without proper clearance and preparation by
Dr. Arney

All laboratory records are to be entered directly into the notebook and not on loose paper
or a portable computer.

I am solely responsible for any materials or gadgets that bring to the laboratory and any
damage or destruction to them in the laboratory is my responsibility to bear.

Signed : _____

Date: _____

Chemistry 426

Advanced Integrated Laboratory Techniques

EXPERIMENTS

Spring 2011

Report Format :

Each experiment will have a different report with different requirements. Most of these procedures include specific report elements that must be included. However, all reports will share these common elements:

1. Short introduction to explain the nature and goal of the experiment.
2. **Brief** but accurate discussion of relevant theory and/or the procedures used to performed the experiment. In the case of a synthetic experiment, outline the synthetic approach utilized.
3. Discussion (Presentation) of the Results:
 - a. discuss how each reaction (measurement) is performed and discuss any problems that arose.
 - b. include the important measurements and their significance and/or problems.
 - c. discuss how each result is calculated. (an example is often helpful)
 - d. most importantly, discuss the significance of the results obtained in terms of the system under study.
4. Experimental Section:
 - a. use the Journal of Organic Chemistry Experimental Section as a model for laboratory procedures.
5. Experimental Notebook Copies.
 - a. the copy pages from your laboratory notebook for the experiment.
 - b. It is imperative that it be clear that the experiment can be reproduced in the lab by a third person using only these sheets and that all data necessary had been recorded during the execution of the experiment.
6. Answers to experimental Problems.
 - a. each experiment has a set of questions and problems that may require some significant pencil on paper or library work to solve.
7. Interpretation of any spectra required or requested as part of the experiment. It should consist of at least a copy of the spectra with structural assignments for the major spectral features shown indicated with a structural drawing.

Those reports for experiments out of *Angelici* should include the items specifically stated in the experiment REPORT section. Any additional components for a report will be indicated with the experimental description.

!!!!!!! Important Dates !!!!!!! :

A report is required from each person by each date specified below. The report must be handed to me (Dr. Arney) on or before **NOON** of the date. After the date, 20% per School Day will be deducted from any potential grade. After five days it is a zero.

Feb. 22, Mar. 20, Apr. 10, May 1, the last before the scheduled final time. **NO WORK WILL BE ACCEPTED AFTER THE SCHEDULED FINAL EXAM TIME.**

ADVISE:

- (1). It is to your advantage to attempt to perform two or more experiments concurrently as most will have significant waiting periods which could be utilized for other experiments and work-ups.
- (2). Prior to lab you must obtain an acceptable procedure for the experiment, from the indicated sources, and prepare to perform the experiment by studying and understanding the operations involved and the nature and handling of the materials to be used.
- (3). The multi-step synthesis is best started as early as possible and performed concurrently with other experiments.
- (4). You will not be "*prepped*" for each lab and are responsible for having the appropriate procedures and knowing the proper use of equipment. However, potentially hazardous operations will be monitored and **NEW** procedures, such as vacuum distillations will be discussed and demonstrated as necessary.
- (5). The T.A.'s primary function in the laboratory is for safety and to provide the necessary material and equipment. The T.A. is not a source of information on the performance of the experiment and does not have a clue to the question "does this look right?"

Experiments to be Performed: .

1. **‡Stability Constants of Ni(glycinate)_n⁽²⁻ⁿ⁾⁺**. Handout procedure based that found in *Angelici*(exp 22). Determination of the stability constants for the complexation of Ni²⁺ ion by glycine as a bidentate ligand. **In addition to the regular report format**, the data and calculations must be neatly and clearly set-up in an MS-Excel Spreadsheet which will be turned in with the report via e-mail attachment.
2. **Inorganic Syntheses: Acetylferrocene & Manganese(III) acetylacetonate** Preparation of acetylferrocene by Friedel-Crafts acylation and purification by column chromatography. Paramagnetic Mn(acac)₃ is prepared by treating KMnO₄ with acetylacetone. The symmetry and fluxionality of the ferrocene rings and the magnetic susceptibility of Mn(acac)₃ are characterized via NMR techniques.
3. **‡Kinetics Investigation of the Nucleophilic Aromatic Substitution Reaction:** Spectrophotometric measurements of the reaction of piperidine with 2,4-dinitrochlorobenzene will be utilized to determine the rate constant of the reaction at several temperatures and the thermodynamic properties of the transition state will be calculated to gain a better understanding of the rate-determining process.
4. **‡Multistep Organic Preparation with Stereochemical Assignment Based on Calculated NMR Parameters.** Indene will be methylated to give 1-methylindene. Hydroxylformyloxylation of the 1-methylindene gives four major products, one of which

will be isolated as a pure single diastereomer. Hydrolysis of the product gives a glycol whose stereochemistry will be assigned based comparison with calculated NMR chemical shifts and coupling constants obtained from the Gaussian03W software. For each isolated compound a complete set of high-field NMR spectra will be obtained including 2D correlation spectra such as COSY, DQF-COSY, HMQC.

5. ‡**Hückel Molecular Orbital Computational Lab.** Introduction to the theory and application of Hückel MO theory is covered in some illustrative but revealing cases. Provides some introduction to the use of matrix methods and systems of equations. This is a “dry” laboratory focusing on the enhancement of mathematical skills and understanding of theoretical applications.
6. ‡**Approximate Solution of the Hydrogen atom Numerical Methods by Spreadsheet.** The wavefunction for the one electron hydrogen atom is approximated by a linear sum of four Gaussian functions and its coefficients are optimized by solving the Schrodinger equation for the best energy. This lab focuses on introducing the numerical matrix methods utilized in *ab-initio* software and becoming familiar with much of the non-obvious aspects of MO work. Application of the derived approximate wavefunction will be compared to the exact wavefunction. Matrix-LinAlgebra add-in for Excel, allows us to focus on the general methods more clearly.
7. ‡**Chemometrics of Aqueous Metal Ion Mixtures using Least Squares Analysis and the Moore-Penrose Matrix.** Introduces the use of whole spectra for the quantitation and identification of the UV/Vis active metal ions in an aqueous mixture. The linear least squares (LLS) method is applied to spectra, which are treated as a collection of absorbance at distinct wavelengths. The equivalence of the Moore-Penrose Pseudo-Inverse matrix to the LLS method is shown in theory and practice.

‡ indicates that a handout or a rewritten version of the experiment will be available on BlackBoard.

SAM HOUSTON STATE UNIVERSITY

COURSE SYLLABUS, CHM 480 FORENSIC CHEMISTRY, 3 CREDIT HOURS Spring 2011

Course Information

- Darren L. Williams, Ph.D. (a.k.a. DW)
 - Office: CFS 317 G, Campus Box 2117, Huntsville, TX 77340
 - Contact (936)294-1529, williams@shsu.edu, http://www.shsu.edu/~chm_dlw/, and on FaceBook.
 - Office hours are 10 to 11 AM, MTWTF, and other times by appointment. Email is the preferred method for communication and for making appointments.
- Lecture will meet in CFS 102 on Tuesday and Thursday from 8 to 9:20 AM.

Required Textbook

- Forensic Chemistry, Bell, Pearson, 2006. (ISBN: 0131478354)

Course Description

This is a one semester course focused on surveying important aspects of chemistry to forensic inquiries. Focus will be on the validity of results. Techniques and methods for selecting proper techniques to answer various questions will be discussed. Writing Enhanced. Prerequisite: A minimum grade of C in CHM 239, 440 and 467 (or concurrent enrollment in CHM 467); MTH 142. Spring. Credit 3.

Course Objectives

1. IDEA Objective #4: To develop specific skills, competencies, and points of view needed by professionals in the field.
2. IDEA Objective #8: To develop skill in expressing oneself orally or in writing.

Enabling Objectives

1. Study the requirements of critical-quality analysis of drugs and physical evidence including accelerants, explosives, inks, paints, polymers, and fibers.
2. Following a process of your choosing, charting its performance, and reporting on its control.
3. Writing a quality control report detailing the performance of your process over the semester.

Assessment

To determine the final course grade, the student's numerical average will be compared to course requirements, to peer performance, and to the definitions set forth in the University Catalog (Scholastic Requirements). Specific grade cut-off values are not predetermined because of the semester-by-semester variation of exams, classes, hurricanes, and other circumstances.

Items	Weight
Attendance	5%
Homework	5%
Control Chart	5%
Quality Report	10%
Exams	75%

TENTATIVE LETTER GRADES are provided as a service to the student for midterm grade evaluation. This will allow the student to make an informed decision related to the two drop dates in the semester.

1. The 12th class day is the last day to drop with a full refund.
2. The last class day is the last day to withdraw from the course. (DW's signature is needed.) (Scholastic Requirements).

Exams

- Exams will be announced in class and on Blackboard.
- Exam questions will be very similar to the homework questions. About 10% of the exam will be from the A-level material posted on Blackboard.
- All exams will utilize the Scantron form 882-E. The exams will remain the property of SHSU as a record of student performance. The students are encouraged to visit with DW to see the key and to understand their strengths and weaknesses related to their exam performance.

Missed exams:

DW does not give make-up examinations. In the unfortunate case, where a student misses an exam, DW will discuss possible remedies with the student provided that all the following conditions are met:

1. The student was absent on the exam date.

2. The student telephoned in advance or left a voice mail message or email message alerting DW to their absence along with a description of why they will miss (have missed) the exam. (All information will be kept in strict confidence.) DW reserves the right to modify the grading scheme such that the final exam may compensate for the missed exam course percentage. DW also reserves the right to assign an exam grade of 0% should he deem the absence was not properly handled or was unjustified. Appeals will be handled in accord with University Policy Statement 900823, Academic Grievance Procedures for Students.

The final exam is probably Thursday, May 12, 2009, 8 AM to 10 AM.
 (Online Schedule: <http://www.shsu.edu/students/finalexam.html>)
Modify your plans NOW to fit your academic schedule.

Homework (HW)

- The homework assignments (pdf file) should be printed and worked with pencil and calculator. Once complete, the Blackboard online test can be taken where the answers can be entered. The electronic test and the hard-copy assignment are identical.
 - The student is encouraged to rework the problems that were missed. The electronic test can be taken **three times** so a 100% grade on the homework is within everyone's reach.
 - Academic performance on the homework problems is based upon the honor system. The student should have enough self-respect to do their own work. If students depend upon others to tell them which answers to choose, **it is very likely that the cheating student will fail the mid-term exams.**
 - It is up to the student to check their grades on the Blackboard system.
 - If an online homework set is not properly completed, then a lock (in progress) appears in the gradebook. If this happens to you, email DW as soon as possible to reset the attempt.
 - The gradebook in Blackboard will be updated after each exam. At that time, all locked assignments turn to ZEROs.
- If you procrastinate, and lock up your 1st attempt the night before the HW is due, then **you will get a zero.** You have three attempts, so use one early to ensure you have a non-zero grade.

Process Monitoring

Each student will choose a continuously variable process that they can monitor DAILY the whole semester. The data will become a control chart. Weekly comments will be required, and the whole semester will be evaluated in a final quality report.

Quality Report

The quality report will be based upon the control chart of the student's process monitoring. It will address all significant quality events, give estimates of the reliability of the process, etc. More details will be given on Blackboard..

Attendance

Forgetting to sign the roster is equivalent to an absence.

- In accord with university policy, students will not be penalized for absences of up to three hours as long as examinations and other assigned work have not been missed. Table 1 explains the attendance score.
- The student is responsible for signing the roster at the beginning of each class period.
- **Giving points for attendance is a gift** for simply showing up and signing your name on a roster. I have seen that students always do much better on exams if they actually come to class. In other words, attendance is the pathway to a good exam grade.
- **There is one policy for all students** including athletes, band members, campus leaders, etc. Your school-sponsored activity may require you to miss more than 3 lectures. This will not severely impact your numerical average because attendance is only 5% of your total average. You do not get any extra or excused absences, and DW doesn't need

Table 1: Attendance Grading Scheme

Number of Absences	Attendance Score
1 to 3	100%
4	80%
5	60%
6	40%
7	20%
8 or more	0%

notes or letters. You must work harder to perform on the exams having missed the lecture material. This is what is expected of leaders.

Employment Recommendations

For Your Information: Dr. Williams will not write recommendation letters for students who do not make a B or better unless there is some very unusual reason to do so.

Academic Dishonesty

- Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. The University may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including, but not limited to, cheating, plagiarism, and the abuse of resource materials.
- DW reserves the right to ask for an oral explanation of work submitted to determine if the student actually performed the work. This should not be construed as an accusation of academic dishonesty. Only in cases where the student cannot demonstrate the most basic explanation of what they submitted as their original work will there be any question of dishonesty.
- If DW believes that exam work or a homework assignment is a copy of another student's work, BOTH students may receive a grade of 0%, and disciplinary action will be considered.

Classroom Rules of Conduct

Students will refrain from behavior in the classroom that intentionally or unintentionally disrupts the learning process. Cell phones must be turned off before class begins. Students are prohibited from text messaging, emailing, Facebooking, or engaging in any other form of distraction. Students who are especially disruptive will be asked to leave and may be reported to the Dean of Students for disciplinary action.

Visitor Policy

Dr. Williams will decide whether or not visitors will be allowed to remain in the classroom.

Americans with Disabilities Act

No disability accommodations can be made until the student registers with the Counseling Center.

Religious Holidays

University policy (APS 861001) and state law (Section 51.911(b), Texas Education Code) require that a student who is absent from class for the observance of a religious holy day fill out form (see APS 861001) in the first week of class. This form must be signed by the instructor, the student, and approved by the departmental chair.

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SAM HOUSTON STATE UNIVERSITY

Topic List for CHM 480
Forensic Chemistry
Spring 2011

Statistics, Sampling and Data Quality
Calibration and Quality Control
Six-Sigma, Lean, Gage R&R Analysis
Separations: Extraction and Chromatography
Instrumentation: Microscopy and Spectroscopy
Drugs and Pharmacology
Drug Analysis Techniques
Drugs of Abuse
Combustion, Arson, and Explosives
Explosive Safety and Handling
Combustion Evidence
Color Chemistry
Color Prediction
Inks and Paints
Polymer Chemistry
Polymer-solvent interactions.
Fiber Evidence

COURSE SYLLABUS

(Tentative**)

CHM 443W

Structural Spectroscopic Methods

4 semester credit-hours

Sp 2010

Lect: CFS 104 MWF 10:00-10:50 AM CFS 104

Lab: CFS 313 TuTh 1:00-4:50 PM CFS 313

(The Student Acknowledgement Form at the end of the syllabus must be completed, signed, and turned in to the Instructor by Jan. 25, 2010)

Instructor:	Dr. Benny E. Arney	Semester:	Spring 2010
Office Phone:	294-1531 off-campus ext. 41531 on-campus	Email:	CHM_BEA@SHSU.EDU
Office: Check each room	CFS 326 Or CFS 305 Or CFS 323	Office Hours:	MW : 11:00-11:30 AM TTh : 8:30-11:00 AM
Website	Blackboard at www.shsu.edu		

Textbook (required): Silverstein, Webster, & Kiemle, "Spectrometric Identification of Organic Compounds", 7th ed., John Wiley & Sons, New Jersey, 2005, ISBN 0-471-39362-2. **Must bring book to every class.**

Description:

This course will focus on the elucidation of structural information from a sample using spectroscopic methods such as MS, IR, NMR. The NMR will cover 1 and 2 dimensional techniques as well as heteronuclear observation (i.e. nuclei other than ^1H or ^{13}C). The laboratory will focus on providing a hands-on experience of sample preparation and spectral acquisition. The Primary Focus is deriving the structure of an unknown material by the use of its spectral data alone. Extensive use of problem sets will be made to give the student the practice and experience to decisions.

The laboratory component will consist of becoming proficient in the basic operation of each instrument used including; sample preparation, obtaining routine spectra, interpretation of the spectra obtained, and handling of raw data obtained. Specific Guidelines and Hand-Outs will be provided on BlackBoard and in the laboratory (CFS 313).

Prerequisites:

Students in this course must have successfully completed CHM 239 & CHM219 with a grade of C or higher. The students are expected to be proficient in the nomenclature, vocabulary, and principles from General Chemistry and Organic Chemistry which will be included in testing and course materials.

Study Requirements:

Most of the important learning in this class will be **SELF-LEARNING or SELF-TEACHING**. Class time is best used to work on applying the readings and material. The acquisition of skills comes with the repetition of problem solving. **Attending class and writing notes will NOT be enough for most students to pass the class.** Each student must find the level of interaction with the material necessary to succeed. Study groups may be excellent methods for many students. **Remember you are responsible for your advancement.**

WARNING:!!

Use of the Internet or reference materials, not specifically designated by the professor for use in this course, to work on problems or assignments will constitute grounds for failure and disciplinary action through the office of the Dean of Students.

Required Materials:

You are required to bring your book to class. Requisite material from CHM 138/139 includes, but is not limited to, bonding, structure, equilibria, thermodynamics, and nomenclature of common ions, ionic compounds, binary compounds, and acids. Also, you are expected to attempt to work as many of the problems in each chapter as possible.

Questions in Class:

If you ask a question in class, I generally will not answer it directly, but will ask you questions to find the source of the question or to lead you to the proper question you should have been asking. Most questions arise because of inadequate background or misunderstanding of a prior concept or material. Just providing you an answer to write in your notebook would not solve the problem.

If I ask a question in class, especially one that should be easily answered if a student is keeping up and understanding the material, I will wait for the class to arrive at an acceptable answer. Do not consider this class a spectator class where you show up take notes and then study before the test.

Attendance Policy:

It will be essential for you to attend class regularly if you desire to perform well. Class attendance will not be used, however, as a criterion for evaluating student performance.

Writing Standards:

Students enrolled in this course are expected to use literate and effective English in their speech and in their writing. All work submitted must be well-written; grades on written work (including examinations) will be based on expression as well as on content. Remember that improper grammar can drastically modify the meaning of a statement.

Objectives: Skills to be Acquired in This Course:

This is a course focused primarily on the interpretation of spectrometric data and its use to deduce as much structural information as possible with regards to the sample available. Regardless of your specific major, the demands of the course will be same for all students as will also the testing. It is an overall goal of this course to improve the problem solving skills and understanding of chemical systems of all students enrolled.

1. General understanding of the correspondence between molecular structure and spectroscopic response.
 2. Specific information available from each spectrometric method.
 3. Information not available from each spectrometric method.
 4. Ability to discern structural data and connect them together.
-

Examinations & Quizzes:

The grading for this course will be composed of three components:

A. Problem Sets (5@)	40 %
B. Lab Assignments (5@)	30 %
C. Mid-Term&Final (15%/@)	30 %
Total	100 %

Problem Sets: There will be two types of problem sets those that we work as a class to illustrate the approaches one can take to solving these problems and those assigned to be worked for a grade. Those assigned for a grade must be worked independently without any assistance aside from the specific texts or materials allowed by the instructor. The students may not discuss them with each other with the lone exception of asking specific questions to the instructor during the assigned class time so that all may hear both the question and any answer that the instructor may provide.

Each lab assignment will be composed of 2 parts, the first of which is usually performable within a single lab period but some of which may require an extensive amount of tinkering to "get it just right". The second part will be obtaining presentable spectra of a set of unknown compounds that will be used to perform their identification. The last lab assignment will be the identification of the group of unknowns.

The mid-Term and Final will be two (2) 2-hour Blue-book tests. The Midterm will be taken at the syllabus assigned time in the laboratory time slot and the Final will taken at the University assigned time in the class-room space.

Test Format & Content:

Each test will be comprehensive and open-book. However, it must be remembered that the book will only be useful if you have been continuously using it for problems. Working the problems at the ends of each chapter is the best way to study and evaluate your progress in this course and prepare for the tests.

Make-up Tests:

There are none. Do not ask for them.

Late Work:

Will not be accepted and will be recorded as zeros.

Grading:

If a student earns $\geq 40\%$ on the final, a letter grade will be assigned based on their total accumulated points:

Grade	Undergraduate	Graduate
4 (A)	90 - above	93- above
3 (B)	80 – 89.99	84 – 92.99
2 (C)	70 – 79.99	75 – 83.99
1 (D)	60 – 69.99	
0 (F)	<60.00	<75.00

IF a grade of less than 40% is earned on the final, an F will be awarded regardless of previous points.

ADA Policy:

SHSU adheres to all applicable federal, state, and local laws, regulations, and guidelines with respect to providing reasonable accommodations for students with disabilities. If you have a disability that may affect adversely your work in this class, then I encourage you to register with the SHSU Counseling Center and to talk with me about how I can best help you. All disclosures of disabilities will be kept strictly confidential. NOTE: no accommodation can be made until you register with the Counseling Center.

Academic Dishonesty (Cheating) Policy:

“All students are expected to engage in all academic pursuits in a manner that is above reproach. Students are expected to maintain complete honesty and integrity in academic experiences both in and out of the classroom. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. The University and its official representatives may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including, but not limited to, cheating on an examination or other academic work which is to be submitted, plagiarism, collusion and the abuse of resource materials.” And for this class, use of any resource other than those specifically designated by the instructor (especially the internet) will be grounds for automatic failure and possible disciplinary action from the Dean of Students.

Inappropriate Classroom Conduct Policy:

“Students will refrain from behavior in the classroom that intentionally or unintentionally disrupts the learning process and, thus, impedes the mission of the university. Cellular telephones and

papers must be turned off before class begins. Students are prohibited from eating in class, using tobacco products, making offensive remarks, reading newspapers, sleeping, talking at inappropriate times, wearing inappropriate clothing, or engaging in any form of distraction. Inappropriate behavior in the classroom shall result in a directive to leave class. Students who are especially disruptive also may be reported to the Dean of Students for disciplinary action in accordance with university policy."

Visitors to the Classroom:

"Unannounced visitors to the class must present a current, official SHSU identification card to be admitted in the classroom. They must not present a disruption to the class by their attendance. If the visitor is not a registered student, it is at the instructor's discretion whether or not the visitor will be allowed to remain in the room."

Schedule for Lecture Topic: CHM443

Date	Topic	Reading Assignment
Jan 13	Introduction	Chap 1
15	Mass spectrometry: Ionization Methods	
20	Interpretation of EI and CI MS: Molecular formula, isotopic distributions, HRMS, Beynon Tables, Degrees of Unsaturation.	
22	Fragmentation and Rearrangements: General, hydrocarbons, alkyl halides.	
25	Alcohols, ethers, ketones, aldehydes, carboxylic acids and derivatives	
27	Nitrogen containing compounds: amines, amides, nitro compounds, nitriles, nitrite, and nitrates.	
29	Problems and questions: various MS-structural problems Twelfth Class Day. Last day to drop without a "Q" and receive 100% refund. (This does not apply to dropping your only course. Please refer to the University Catalog for refund information.)	
Feb 1	Infrared: Introduction, theory, and hydrocarbons.	Chap 2
3	Hydrocarbons, alcohols, ethers, ketones, and aldehydes	
5	Carboxylic acids and derivatives	
8	Amines, amides, nitriles, amine-salts, Problem Set #1 DUE	
10	Nitro, nitroso, cumulated compounds	
12	Problems and questions: various IR/MS structural problems.	
15	¹H Nuclear magnetic resonance: Introduction & theory, spin, magnetic fields, excitation, and detection.	Chap 3
17	Chemical Shift Equivalency, Chemical shifts, spin-coupling	
19	Spin systems, exchangeable protons, magnetic equivalency.	
22	Coupling to other Nuclei: ² H, ¹⁹ F, ³¹ P, ²⁹ Si, and ¹³ C	
24	Chirality, vicinal and geminal coupling, Decoupling-Double Resonance. Problem Set#2 DUE	

26	NOE-spatial proximity	
Mar 1	Problems and questions: Various $^1\text{H}/\text{IR}/\text{MS}$ structural problems	
3	^{13}C Nuclear magnetic resonance: theory, T_1 relaxation, NOE, ^{13}C - ^1H coupling, sensitivity, Broadband Decoupled.	Chap 4
5	Off-resonance decoupled, gated decoupled (quantitative), gated coupled and DEPT.	
8	Chemical shifts, Chemical shift equivalency	
10	Chemical shifts of major classes	
12	Empirical calculation of ^{13}C Chemical Shifts, <u>MID-TERM (March 12) Problem Set#3 DUE</u>	
22	Problems and questions: Various $^{13}\text{C}/\text{H}/\text{IR}/\text{MS}$ structural problems	
24	Correlation NMR : theory	Chap 5
26	^1H - ^1H correlation: COSY & ^{13}C - ^1H COSY: HECTCOR	
29	Double Quantum Filtered, Inverse-detection Methods, HMQC, HMBC.	
31	^{13}C - ^{13}C COSY: Inadequate, TOCSY, ROESY(NOESY) Problem Set#4 DUE	
Apr 2	Good Friday. Holiday for Students and Faculty.	
5	Problems and questions	
7	NMR of Other important Spin $\frac{1}{2}$ Nuclei:	Chap 6
9	^{15}N , ^{19}F	
12	^{29}Si , ^{31}P	
14	Problems and questions:	
16	Solved Problems and problems from other sources.	Chap 7
19	Problems and questions	
21	Problems and questions	
23	Problems and questions	
26	Problems and questions	
28	Problems and questions Problem Set#5 DUE	
30	Problems and questions	
May 3	Problems and questions	
5	Problems and questions	
7	Final Exam Study Day. Last Day to Resign (SEE RESIGNATION INFORMATION BELOW). Last day for dropping Spring Semester courses without grade of F	
	!!!!!! FINAL EXAMINATIONS !!!!!!!	

** This document is tentative in that changes may be made as deemed necessary by the Professor in order to achieve the objectives of the course.

Student Acknowledgement of Syllabus:

I, _____ (*your name*) having SHSU ID# _____, have printed the syllabus for CHM 443 (Spring 2007). I further acknowledge that I have read the syllabus and that I am familiar with and understand its contents. I also recognize that my continuance in this course requires that I agree to its content and requirements and that changes to this syllabus are only possible if they further the aims of the course as deemed appropriate by the professor.

I am also aware that questions and/or problems with the course must be addressed to the instructor. If these problems are not part of the day's scheduled material, it should be addressed after class, during office hours, or by appointment.

Signed : _____

Date: _____

 Syllabus

 Syllabus Spring 2010 ASC Detail

Tentative Syllabus Chemistry 368 Environmental Chemistry

Spring 2010

Dr. Tom Chasteen	294-1533	chm_tgc@shsu.edu
Office hrs. 8-9 am MWF	8-9:30 am TTh	or by appointment anytime

Text: Environmental Chemistry Fourth Edition by Baird and Cann (Freeman, 2008).

The material in the course includes the following material in your text:

- Introduction to Environmental Chemistry
 - Green chemistry
 - Cradle to grave chemicals
 - Mass Balance as a means of minimizing dangerous waste
- Chapter 1: Stratospheric Chemistry (27-50.5; 53.5-end)
 - Atmospheric thermal structure, layers
 - Solar spectrum
 - UV_a,
 - UV_b,
 - UV_c,
 - visible,
 - and infrared spectra
 - Atmospheric absorbance spectrum
 - Composition of the troposphere, stratosphere, beyond
 - Chapman mechanism
 - The stratospheric ozone layer, O₃ creation and destruction
 - Gas phase concentrations, ideal gas law, ppbv, etc.
- Chapter 2: The Ozone Holes (entire chapter)
 - Natural gas-phase catalytic destruction of ozone, NO
 - Anthropogenic gas-phase catalytic destruction of ozone, Cl
 - Polar stratospheric clouds
 - Heterogenous destruction of ozone
- Chapter 3: The Chemistry of Ground-Level Air Pollution (91-115; 129-132.25)
 - Anthropogenic sources of NO_x, the internal combustion engine
 - Anthropogenic sources of unburned hydrocarbons
 - Photolysis' role in urban smog
 - Catalytic converters
 - Particulates
 - Externalities
- Chapter 6: The Greenhouse Effect (205-224; 229.5-241; 251.5-end, pages 402-411: A Plan to Keep Carbon in Check)
 - The Earth's thermal balance
 - IR-absorbing gases
 - Atmospheric residence times
 - The natural greenhouse effect
 - Anthropogenic IR-absorbing gases
 - Historical records of greenhouse gases
 - The historical temperature record
 - IPCC reports

- Models and the future
- Chapter 7: Fossil Fuel Energy (261-274; 282-292.5; Table 7.2; 304-end)
 - Sources of anthropogenic greenhouse gases
 - Coal
 - Natural gas
 - Oil
 - Shale
 - Lifetimes of greenhouse gases
 - Other components of fossil fuel emissions
- Chapter 8: Renewable Energy (311-328)
 - Alternatives to fossil fuels
 - Wind, Solar, Waves
 - Biomass feedstocks
 - Hydrogen
 - What's the cheapest source of hydrogen now?
 - Cost benefit analysis
- Chapter 10: Pesticides (415-428; 434-441.25; page 457 Genetically Engineered Plants)
 - Fungicides, bactericides, insecticides, algicides, etc.
 - Historicals: sulfur, arsenics, DDT
 - Bioaccumulation, biomagnification
 - Organochlorines
 - Organophosphates
 - Carbamates
 - Phenoxies
 - Glyphosate, Round up ready crops
- Chapter 9: Radioactivity, Radon, and Nuclear Energy (entire chapter)
 - Radioactive decay
 - Isotopes
 - Subatomic particles
 - Alpha, beta, gamma emission
 - Uranium decay series
 - Radon
 - Spontaneous fission
 - Induced fission
 - Nuclear reactors
 - Reactor safety
 - Nuclear waste
 - Fuel reprocessing
- Chapter 15: Toxic Heavy Metals (663-670.25; 679-685.25; 694.8-end, Pages 775-776)
 - Mercury
 - arsenic
 - chromium, chromarsenic wood preservatives, organo-replacements
 - lead
 - Cadmium
 - Selenium and tellurium
- Chapter 16: Recycling (713-730)
 - Reduce
 - Reuse
 - Recycle
 - Superfund sites
 - Cost benefit
 - Use it up, wear it out, fix it up or do with out

The grades will be based equally on three one hour tests and a two hour final (each 25%).

The test dates are all on Fridays (you're welcome):

- Test 1 February 12,
- Test 2, March 12,
- Test 3, April 16,
- The Final Exam will be 2 hours long and has been scheduled for Wednesday May 12 at 11 am-1 pm.



Course Grading

(The scheduled test dates are not negotiable but may be changed by the instructor.)
The grades in this class will be assigned in the following way:

greater than 89.5% = final grade of A

79.5 to 89.5 B

69.5 to 79.5 C

59.5 to 69.5 D

less than 59.5 F

Three 80 minute tests = 75%

The final = 25%

Excessive absences, tardiness, or leaving early will adversely affect your grade in the course. Your course grade may be lowered with more than two unexcused absences.



Course Description

CHM 368 ENVIRONMENTAL CHEMISTRY. The chemical principles underlying the effects of air, water, and soil pollution are covered. Specific attention is paid to gas phase radical reactions, light absorption characteristics of atmospheric components, solution chemistry of fresh and salt water systems, and the mobility and chemistry of metal components of soil systems. Prerequisites: A minimum grade of C in CHM, 241, 238 and 239 (or concurrent enrollment in CHM 239). Spring. Credit 3.



Required Calculator

To limit the use of memory-intensive calculators that can store text, formulae, and chemical nomenclature, you are required to use a Texas Instruments TI30 model calculator in this course during in class tests. There are multiple different TI30 models and all of them will work but I suggest the TI30Xa. Other calculators like TI Models TI34 and TI36 don't meet this requirement.



Purpose of this course

The purpose of this 3 semester hour chemistry course is to provide a broad introduction to the chemistry of the environment, specifically centering on the atmosphere, the aquasphere, and the pedosphere.



On-line Assignments

Note that the Blackboard server is routinely backed up in the middle of the night. When this occurs, Blackboard will not be available to you for as long as 1.5 hours. The time of the backup is somewhere around 3 am but may change. Before you arrange your schedule to routinely complete your online assignments in these wee hours, e-mail the SHSU help desk (helpdesk@shsu.edu) and ask them specifically "At what time is the Blackboard server NOT AVAILABLE because of maintenance or backup procedures?" then make your plans accordingly.



Additional Syllabus Material

Additional very important syllabus material is here

Text: Required: Atmospheric Pollution; Mark Z. Jacobson (University of Cambridge: ISBN # 0-521-01044-6)

Class Meeting Time: Meets in Chemistry/Forensic Science Room 104 TTh 11:00 am - 12:20 pm

Lab Meeting Time: Lab Meets in Chemistry Forensic Science Room 309 Tuesday 1:00 pm - 4:50 pm

Office Hours: Dr. Tom Chasteen's Office Hours (Chemistry Forensic Science Building Room 317E)

- 9:00 am to noon MWF
- 9:30 am-11:00 am Tuesday and Thursday
- E-mail Office hours almost anytime: chasteen@shsu.edu

Chapter	Title	Comments
1	Basics <ul style="list-style-type: none"> • History of the early atmosphere • Component reactivity • Atmospheric Lifetimes 	Pages 2 to 4.25; Sections 1.2.3 to chapter end and section 1.4 especially
2	Evolution of Earth's Atmosphere <ul style="list-style-type: none"> • Solar Spectrum • Early Earth's Atmosphere • Major component cycles 	Section 2.1, 2.2 (without equations), 2.3 intro, 2.3.5 to chapter end and especially determining the oxidation states of all nitrogens in Figure 2.11
3	Structure of the Modern Atmosphere <ul style="list-style-type: none"> • Atmospheric pressure and density • Atmospheric thermal structure • Atmospheric compositions <ul style="list-style-type: none"> ◦ Permanent gases ◦ Particles 	All sections
	Stratospheric Ozone <ul style="list-style-type: none"> • The ozone layer • Chapman mechanism • Chlorine 	

<p>11</p>	<ul style="list-style-type: none"> • catalysis • Bromine catalysis • Antarctic ozone hole • Arctic ozone hole • Role of CFCs • Increased UV • The Montreal Protocol • 	<p>Sections 11.1 through and including 11.3.2 (exclude sections 11.3.3 and 11.3.4), include 11.4 through and including 11.5, section 11.7 through chapter end; equations 11.2, 11.4, 11.6, 11.7, 11.21, 11.22, 11.23, 11.24, 11.25, 11.27 (chlorine sequestration), 11.35 (PSC surface reaction, and 11.39 (Cl₂ photolysis)</p>
<p>12</p>	<p>The Enhanced Greenhouse Effect</p> <ul style="list-style-type: none"> • The cold earth <ul style="list-style-type: none"> ◦ See Mars; think about Venus ◦ Our atmosphere with the Greenhouse Effect ◦ The temperature of earth since the Industrial Revolution ◦ The future ◦ Carbon regulation ◦ Cap and Trade ◦ A carbon tax ◦ Externalities 	<p>Exclude section 12.3.2</p>
<p>4</p>	<p>Urban Air Pollution</p> <ul style="list-style-type: none"> • Early US pollution regulation • Background troposphere • Urban smog <ul style="list-style-type: none"> ◦ NO_x ◦ VOC ◦ Photolysis • Diurnal cycles for urban smog 	<p>Exclude sections 4.3.2 through 4.3.7 inclusive and include Lewis dot structures of radicals</p>
	<p>Effects of Pollution</p> <ul style="list-style-type: none"> • Pollutants that affect atmospheric visibility • Particulates 	

7	<ul style="list-style-type: none"> • Particulates • Gas phase scattering • Why the sky is blue. • Twilight colorations • Mesospheric clouds 	Section 7.1 through section 7.1.1.1, Section 7.1.2.0, section 7.1.2.2, Section 7.3 to chapter end
8	<p>International Urban Air Regulation</p> <ul style="list-style-type: none"> • US regulation • International regulation 	All sections
5	<p>Aerosol Particles</p> <ul style="list-style-type: none"> • Size distribution <ul style="list-style-type: none"> ◦ Nucleation mode ◦ Accumulation mode ◦ Coarse mode • Particle shapes • Particle health effects 	Sections 5.1, 5.32 through chapter end
6	<p>Meteorology and Air Pollution</p> <ul style="list-style-type: none"> • Movements of the atmosphere • Circulation • Fronts/Pressure systems • Temperature inversions • Meteorological effects on local pollution • Meteorological transport of pollution 	Section 6.6
9	<p>Indoor Air Pollution</p> <ul style="list-style-type: none"> • Indoor pollutants • The EPA had a sick building • Indoor pollutant regulations 	All sections
	<p>Acidic Atmospheric Deposition</p> <ul style="list-style-type: none"> • History of 	

10

- atmosphere acids
- Atmospheric acids
- Sulfur dioxide --
-> H_2SO_4
- NO_x ---> HNO_3
- Atmospheric bases
- NH_3
- Acid rain and acidic lakes
- Neutralization of acidic lakes in upstate NY
- US acidic regulations
- Cap and Trade success for SO_2 emissions

Section 10.1 through 10.5, Section 7 through chapter end

There will be three 80 minute long tests, and a two hour final:

- The first test date is Thursday, February 10, 2011.
- The second test date is Thursday March 24, 2011.
- The third test date is Thursday, April 14, 2011.
- The final exam is scheduled for Thursday, May 12, 2011 @ 11 am to 1 pm. This is a two hour final.

(The scheduled test dates are not negotiable but may be changed by the instructor.)

The grades in this class will be assigned in the following way:

- greater than 89.5% = final grade of A
- 79.5 to 89.5 B
- 69.5 to 79.5 C
- 59.5 to 69.5 D
- less then 59.5 F

Three 80 minute tests = 50%

The final = 20%

Lab reports = 15% (if two or more labs are not submitted the whole lab grade will be zero)

Homework postings = 15%

Attendance

Attendance is required. Since this is a Tuesday/Thursday class, two unexcused absences are allowed. Any tests missed because of unexcused absences will result in a grade of zero for that test. An unexcused missed final will result in a course grade of F. Excused absences include medical problems (with documentation from a doctor), death in the family, excused absences while conducting official Sam Houston State University business, or absences approved by the instructor before the time of the absence. After the third unexcused absence the instructor reserves the right to lower the student's final grade. Tardiness, or leaving early will adversely affect your grade in the course.

Required calculator for this course

One other thing that **is required**: a scientific calculator. The word scientific in this context means that the calculator must be able to use scientific notation when entering, storing, and displaying numbers. Scientific notation involves the use of exponents as in the number 6.022×10^{23} . **To limit the use** of memory-intensive calculators that can store text, formulae, and chemical nomenclature, you are required to use a Texas Instruments TI-30 model calculator in this course **during in-class tests**. There are multiple different TI-30 models and all of them will work but **I suggest the TI-30Xa**. TI models such as TI-82, TI-84, TI-34 or TI-36 are not TI-30 series calculators by this definition.

Having your calculator batteries give out during a test will probably land one of my less familiar calculators in your hands and then you will have to struggle to learn that calculator's functions on the fly: possible but no fun! So check your calculator's batteries **before every test**.

You may not use your cell phone during your tests.

Lost your TI-30 model calculator manual? You can download them [here](#).

CHM 442 Air Quality Lab

Home Page Sp 2011

Information

- [Class Information](#)
 - [General Organization of Report Forms for All Experiments](#)
 - [Schedule For Lab Reports](#)
 - [Spring 2011 Lab Groups and Their Order](#)
-

LAST UPDATE: 4/19/2011

Lab Assignments

- [Lab 1](#) Usage of E-mail System
 - [Lab 2](#) Computation & Statistics
 - [Lab 3](#) Data Presentation
 - [Lab 4](#) Introduction to High Performance Liquid Chromatography
 - [Lab 5](#) Analysis of Derivatized Samples Using HPLC
 - [Lab 5b](#) DNPH derivatization of formaldehyde and determination by UV/Vis Spectroscopy
 - [Lab 6](#) Particle Number, Surface Area, and Volume Distribution
 - [Lab 7](#) UV/Vis Absorption & Data Transfer
 - [Lab 8](#) Phenol Determination by Ultraviolet/Visible Spectroscopy
 - [Lab 9](#) Glossary Assignment-I
 - [Lab 10](#) Glossary Assignment-II
 - [Lab 11](#) 1-D Model Study
 - [Lab 12](#) Data Presentation II
-

Lab 2 is copyrighted by [Brian Tissue](#) and has been modified with his permission
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Course Home - CHM442 Laboratory

Individual assigned labs are here

Chemistry 442 Air Quality Laboratory

General Organization of Report Forms for All Experiments

- **I.** Cover Page (Your Name, Course, Title of Experiment, Date)
- **II.** Table of Contents (Listing, by page number, each section of the report, including page numbers of all graphics)
- **III.** Name of the Experimental Technique (include in title of report)
- **IV.** Introduction (Include the chemical family and a Chemdraw structure of the analyte when requested by TA.)
- **V.** Theory on which the instrument is based
- **VI.** Instruments and Equipment (Include at least one schematic of instrument labeling all important components. Some schematics of the components themselves may be necessary. Also include settings or important information regarding your experiment. Explain function of ALL COMPONENTS. It is hard to over-do it.)
- **VII.** Data obtained in the experiment (weights, volumes, all calculations, etc.)
- **VIII.** Experimental Results: graphs, spectra, interpretations, etc. and answers to specific questions that you have been given. Any graphs or tables should be labeled accurately and in a manner that makes them self-explanatory. If you are determining an unknown, the unknown identity and any unknown number should be easily found as a logical portion of your discussion.
- **IX.** Conclusion briefly restating purpose and goals of lab, important data such as unknown identity or concentrations, etc., sources of error (not human), comments.
- **X.** Appendix if spreadsheets for any regression or like analysis, or for any item you feel belongs there. (Ask your TA by e-mail if you have a question about the report.)
- **XI.** References using the following citation format: Einstein, A., Zhang, L., and Chasteen, T.G. Amending cultures of selenium resistant bacteria with dimethyl selenone, *Applied Organometallic Chemistry*, 1994, **8**, 501-508. These part are: Authors, Title, *Journal Name*, Year, **Volume**, inclusive pagination. All parts are separated by commas.

All reports must prepared using word-processing, spreadsheet and drawing (CAD) software. This is a writing enhanced course and you will be scored accordingly. The easiest way to lose points is to not use your word processor's spell checking function or turn your report in late.

Laboratory Period Schedule

In order for this lab to run more smoothly, it is very important that you come to lab

prepared. It is also important that you make it to lab on time. Each week you will be put into groups and each group will have a limited time in the lab. If you come in late, do not expect to run over into another group's time. Lab reports are due when you come into the lab. I WILL NOT accept late labs. Labs are not repeatable, so do NOT plan anything else for your Tuesday afternoons. If you have a legitimate reason for needing to be placed in a certain group, please let me know at least a week in advance and I will do what I can. Commuting to school or wanting to go home early are not legitimate reasons to ask for a modification of the group to which you are assigned. You are required to be present for the entire three hour lab 12:30 PM-3:30 PM every Tuesday. We will do our best to optimize our and your time in this regard. If two or more labs are not submitted and not excused, then the CHM442 lab grade will be zero.

Laboratory Report Schedule

Lab reports are due the following week the lab is performed when your group comes into the lab. They will take a considerable amount of time to prepare so don't put it off until Monday night. All graphs and charts must be inserted into the text of your report-you might need to go to the computer lab to learn how to do this in the beginning. Keep in mind that part of this lab is learning how to present information in a professional manner and as a formal writing project-misspelled words, grammatical errors, and the way you present your data are all part of your grade in this writing enhanced course.

Laboratory Safety

Laboratory safety is very important. You are responsible for knowing the departmental safety rules and following them. You must wear lab glasses the entire time you are in the lab. It is also mandatory that you wear long pants and long sleeves. Violating the safety rules can result in a lowering of grade, loss of entire grade on a lab, or failure in the course.

E-mail your TA for questions or help.

Chemical Literature Seminar
CHEMISTRY 410 (4100) (1 hr)
Sp 2011

Friday, 1:00-2:00

Room 103 CFS

Prof. Chasteen; CFS317e; 936) 294-1533. No assigned textbook.

Office hrs. 10-noon am: 12-1 pm MW; 9:00-11:00 TTh; E-mail **anytime**; chasteen@shsu.edu

Chemistry 410 is a seminar course in chemistry.

Course Objectives:

To develop specific skills needed by scientific professionals in the field of chemistry

To develop skills in expressing descriptions of scientific experimentation orally and in writing

1. Attendance is mandatory. The instructor may lower your final grade after 2 unexcused absences. Excused absences included sickness that involves a doctor or health clinic visit, death in the immediate family, and emergency situations like fires or automobile accidents. Documents for excused absences must be presented by the student to the instructor within one week of the student's return to class. Make sure you sign your name on the evaluation sheet (see below) each week. That's a clear record of your attendance.

2. Each student enrolled in this course is required to present a 15-20 minute seminar on a peer-reviewed research paper available in the scientific literature or their on-going or completed scientific research. The subject may come from any field of chemistry (analytical, biochemical, environmental, forensic, inorganic, organic, or physical).

3. The paper will be selected from the current literature (journals) and a hard copy submitted for approval to Dr. Chasteen at least 2 weeks prior to the presentation date; the earlier the better. Literature **review articles** are not acceptable. The stipulation that it must be a peer-reviewed journal is sometimes difficult to determine. Please contact your instructor well in advance if you have any questions about determining which journals are peer-reviewed. Presentation dates will be chosen on the first day of class. Students presenting at a scientific meeting that semester have priority for earlier presentation dates. Contact a faculty member in your field of interest if you need help selecting a paper. **Missing this (2-week precheck) deadline is the single most common grade lowering error of this course.** Please reread that sentence.

4. A written one paragraph summary of the topic (paper) being presented must be available in the Chemistry office **by 11:00 am** two days before the day when your presentation is made; so that's Wednesday before your Friday talk. You must print off and bring your abstract to the instructor. Your grade in the course will be one letter grade lower if you do not meet this deadline. If no abstract is available one day prior to your presentation day your course grade will be zero. The maximum length of the abstract's body text is limited to 200 words.

Your written abstract will be entitled with the literature paper's title and will list all of the authors, the journal **citation** (abbreviated journal name, volume, year, inclusive page numbers), and **your name**. Pay attention to the format for the citation below.

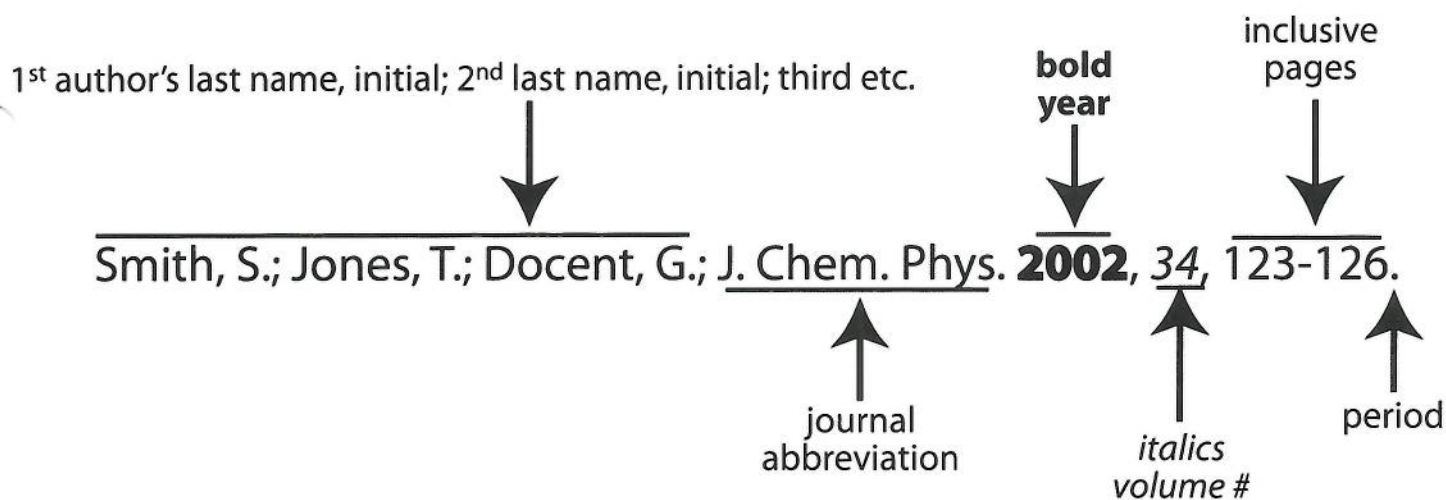
Copying the abstract of your journal paper for your summary is not allowed—this is plagiarism. This is very important. Copying the abstract will result in an F in the course. Period. You must learn to succinctly summarize the important points—that you will present—yourself. Reading lots of abstracts will help you to do this.

Note that the journal abbreviation is italicized; the year is bold, the authors' names separated by a semicolon, etc. No footnotes will be included in the abstract. Do not list the company or school affiliations, or degrees (Ph.D. BS., etc) of the authors. **Make sure the citation ends with a period.** For instance: Smith, S.; Jones, T.; Docent, G., *J. Chem. Phys.* **2002**, *34*, 123-126. If the article you're using is an article in press the citation becomes: Smith, S.; Jones, T.; Docent, G., *J. Chem. Phys.* **2009**, in press.

An abstract describing your research will have your name and the name of your research advisor and any additional workers appropriate. Ask your instructor if there are any questions about this author list. If you are presenting work from your research group that has already been abstracted and presented elsewhere that's OK but you must write a new abstract yourself with no help from your research advisor. The formal abstract writing exercise is ~15% of this course's grade and so submitting a prewritten abstract from your group is not OK. Read that sentence again.

If you bring the printed abstract by to me early I will help you edit it and then you can print of the result with no penalty in points. This will almost certainly increase your grade. Read that last sentence again. The format for scientific citation is important. The anatomy of the citation format we'll use in this class is detailed on the next page. Look carefully, especially when you're writing your abstract.

Anatomy of a citation



In the real citation, nothing is underlined above; my underlining is just used as a means of grouping parts of the citation for you.

5. All students in this course are required to pick up and read a copy of the summary of the talk that week **one or two days before the scheduled talk**. They will be on the table in front of Chemistry's secretary's office (CF317b).

6. Your verbal presentation of the paper that you have selected should include:

a. A brief background of the subject

b. A discussion of the procedures and results of the paper

Leave out superfluous details (experimental volumes used, temperatures, photographs of the instrument from the web, etc.) unless they're important. Inclusion of superfluous detail will lose grade points. Read that sentence again.

c. Conclusions and/or implications based on the results

d. Include graphic images as a visual aid to the presentation (See PowerPoint section below)

Make your images clear—small, poorly labeled graphics are bad. Make the images large enough to be read in the back of a room with 80 seats.

Don't include anything in a graphic that you don't want to explain—too much detail in a graphic can be confusing to your audience.

You may scan figures, tables, and images from your paper if necessary but complex tables should be reduced to include only what is useful to your talk. Digitally cutting images, tables, reactions from your paper's PDF file is best.

Any images or information to display on your slides from other sources besides your paper must be referenced on the same slide. Include a URL if you get that item from the web.

Make sure your PowerPoint background doesn't interfere with your slides' text or images.

Use your graphic images as a means of triggering your verbal presentation. Try not to read directly from your slides nor from index cards if possible.

Be able to pronounce correctly all words on every slide—especially chemical terms.

Make sure you use correct chemical notation (subscripts, superscripts, etc.) in all slides and in your article abstract.

7. Your entire talk **must** be presented as a PowerPoint presentation. This requires that you prepare your talk's Microsoft PowerPoint file **in advance** and check out how it works on a Windows computer prior to the talk. You are responsible for how your presentation displays. CDs you burn yourself or files transported via a disc-on-key (flash drive, memory stick) or network access of your S Drive (if it's healthy) are all OK, but talk to Chasteen in advance about how you plan to access your PowerPoint file.

8. If you include data from outside the paper you've chosen, then provide a readable citation at the bottom of the slide where that data is presented. Do not provide a bibliography at the end of your talk. If you are presenting your own research group's work—some data that's yours and some for others in your group—then you need not provide a citation on slides presenting work from other group members even if you weren't involved in generating that particular data. This is routinely taken care in the scientific community by including an **acknowledgement slide** at the talk's end that recognizes the workers that contributed research to your talk if they weren't in the talk's author list.

9. A period of 5 minutes will be allowed for questions from your audience after you finish as well as spontaneous questions from your audience **during** your talk. A request by a speaker for the audience to hold questions (until the speaker has finished) will probably not be heeded.

10. Presentations will be evaluated by all students and faculty in attendance (see attached sheet). You are required to pay close attention to the talk that someone else gives and fairly evaluate that talk based on the categories on the evaluation sheet. The members of the audience will be evaluated by the faculty as to their attentiveness and ability to **ask questions of the presenter**.

11. A bit about Digital Object Identifier (DOI; see www.doi.org). A DOI address in the case of scientific publications are used to allow access to digitally available documents with one address no matter where the publisher stores the file. Once a paper has been accepted for publications—following the peer review process—a DOI address is assigned and once that address is published—it's usually sent to the authors as soon as it becomes available—submitting that address to the DOI server (example: <http://dx.doi.org/10.1111/j.1574-6976.2009.00177.x>) will send you to at least the abstract of the document and often to a digital version of the entire document.

Example abstract:

Acidosis, lactate, electrolytes, muscle enzymes, and other factors
in the blood of *Sus scrofa* following repeated TASER[®] exposures

Jauchem, J.; Sherry, C.; Fines, D.; Cook, M., *Forensic Sci. Int.*, **2006**, *161*, 20-30.

Presented by Krista Baldys

In recent years, the number of deaths associated with repeated exposure to the Thomas A Swift Electronic Rifle (TASER[®]) has shockingly increased. Several physiological responses, including shifted levels of lactate, hematocrit, potassium, and blood pH, are likely to occur. An experiment was conducted on 10 anaesthetized swine. From those 10, select groups went through different time increments of TASER exposure to all four limbs. Using a blood gas/electrolytes analyzer and other instrumentation, levels of whole blood factors were measured during the pre-exposure period, and several post-exposure periods. Results the scientist saw had a more direct relation of the physiological and biological changes due to muscle contraction rather than the direct electric charge. The decrease of respiration contributed to heighten levels of acidosis during the post-period (one hour after exposure). These effects were found to be short lived and not fatal to a healthy individual. However, these levels found in an unhealthy individual have led to restraint-associated cardiac arrest; ergo, some kind of medical monitoring should be required when individuals are restrained after repeated exposure to the TASER.

The Speaker's Name _____

Your Name _____

Give careful consideration to the following points about the seminar you have just heard and rate the points accordingly. You may take notes during the seminar that you want the presenter to read later. For the following, provide a rating using a scale of 1 to 5 with 5 being the highest rating. Space is left for comments which are encouraged. Add up your points for the final evaluation score.

1. The abstract, which you were required to read, was a clear summary of the material presented in this seminar. It mentioned the important points of the research and the results. The citation format was correct. _____

2. The speaker seemed to be familiar with the material and understood what the paper being presented was about. _____

3. The speaker was able to distinguish the major ideas of the seminar from the supporting material: Superfluous minute details were not unnecessarily presented and important details were included. _____

4. The speaker spoke clearly and distinctly. _____

5. The speaker's presentation materials were clear and useful for the presentation; writing was large enough and graphs were easily read. External material was correctly referenced. _____

6. The speaker answered questions well. _____

7. Your overall evaluation of the seminar. (Add all your points from above.) _____ (0–30)

Experiment Lists

(Primary reviewer's copy)

- Required
- From 4 of the 5 foundation areas:
 - analytical chemistry
 - biochemistry
 - inorganic chemistry
 - organic chemistry
 - physical chemistry
- Each experiment list should include the school name, course name, course number, and year taught
- Each experiment should have a descriptive title with a list of instruments used if applicable
- **Staple the entire packet together. Use only one staple.**

SAM HOUSTON STATE UNIVERSITY

List of Laboratories with the instruments used in Quantitative Chemical Analysis: Laboratory, CHM 241 David E. Thompson - Spring 2011

Lab 1: Formulas, Plots and Basic Statistics in Microsoft Excel

Instruments used: Computer

Lab 2: Error Bars and Statistical Testing in Microsoft Excel and on Graphing Calculators (e.g. TI-84)

Instruments used: Computer, Graphing Calculators

Lab 3: Entering and using the formulas for Linear Least Squares Regression in Microsoft Excel

Instruments used: Computer

Lab 4: UV-VIS Spectrophotometric Determination of Iron

Instruments used: UV-VIS spectrophotometer, Analytical Balance, Computer

Lab 5: Determination of Calcium in a Vitamin Pill by Atomic Absorption Spectroscopy

Instruments used: Atomic Absorption spectrophotometer, Analytical Balance, Computer

Lab 6: Preparing and Standardizing a Sodium Hydroxide Solution

Instruments used: Analytical Balance, Volumetric Glassware, Micropipettes

Lab 7: Determining the Weight Percent of an Unknown Acid via Titration with Aqueous NaOH

Instruments used: Analytical Balance, Volumetric Glassware, Micropipettes

Lab 8: Iodometric Determination of Vitamin C in a Vitamin Tablet

Instruments used: Analytical Balance, Volumetric Glassware, Micropipettes

Lab 9: Preparing and Challenging a Buffered Solution – Testing Acid Base Calculations

Instruments used: pH meter, Analytical Balance, Volumetric Glassware, Micropipettes

Lab 10: Introduction to temperature programming and qualitative analysis on the GC-FID

Instruments: GC-FID, Volumetric Glassware, microsyringes

Lab 11: Quantitative analysis of decane in hexane using dodecane as an internal standard

Instruments: GC-FID, Volumetric Glassware, microsyringes, Computer

SAM HOUSTON STATE UNIVERSITY

CHM 348W Biochemistry Laboratory Fall 2010 Syllabus

Instructor: Dr. Ilona Petrikovics (ixp004@shsu.edu)
Graduate Assistants: Phong Ngo (phong_ngo@shsu.edu)
Suchithra Seneviratna (sas038@shsu.edu)

COURSE DESCRIPTION

CHM 348W Lab is designed to supplement material taught in the lecture section of the course. Students will learn basic biochemistry skills (protein assays, enzyme kinetics, separation techniques, DNA extraction, cloning and analysis) and emphasis will be placed on application of material learned in lecture, scientific writing, and data presentation.

REQUIRED MATERIALS

Text: *Experiments in Biochemistry, A Hands-On Approach, 2nd ed.*, Farrell & Taylor and supplementary protocol, handouts, instructions, and materials available on Blackboard.

Other Supplies: Carbon Copy Lab Notebook and Safety Glasses

METHODS OF EVALUATION

Your lab grade is worth 25% of the lecture section (Introduction to Biochemistry CHM 348W) grade, which will be distributed among the following:

Blackboard Pre-Lab Quizzes (13 total)	10% of lab grade
Notebook Duplicate Pages/Discussion (13 total)	20% of lab grade
Final Exam (Comprehensive of the entire semester)	20% of lab grade
Formal Reports (6 total, refer to Formal Report Guidelines)	60% of lab grade

Grading Scale

A	90 – 100%
B	80 – 89%
C	70 – 79%
D	60 – 69%
F	Below 60%

DELIVERABLES

There will be six Formal Reports assigned throughout the semester that are designed to evaluate your comprehensive understanding of a series of concepts and application of those concepts. Refer to *Formal Report Guidelines Handout* for a more detailed explanation of Formal Report requirements. The interim will consist of duplicate lab notebook pages and discussions dealing with the week's concepts and application of those concepts. Refer to *Lab Notebook Guidelines Handout* for more details.

BLACKBOARD

Blackboard will be used heavily in this course. You will find PowerPoint files, printable pre-lab lecture note handouts there, and supplementary lab protocol, check grades, and take some pre-lab quizzes in Blackboard. You must check both Blackboard and your email periodically (at least once or twice per week) for announcements.

ATTENDANCE POLICY

You are expected to attend all labs. There are no makeup labs, exams, or quizzes. A grade of zero will be given for any missed labs, exams or quizzes. Any request to attend a different lab section other than the one assigned must be made to the senior graduate assistant at least a week in advanced. This is not a guarantee that your request to attend another lab section will be granted.

PROFESSIONALISM IN THE LAB

All students are expected to conduct themselves with the utmost integrity. This includes but is not limited to following all safety protocols, keeping clean work areas, as well as respecting the lab instructor, fellow labmates, laboratory equipment and the laboratory as a whole. A failure of which will not be tolerated and will result in the deduction of points from your lab grade (without your knowledge) or a zero being assigned for that lab week.

ACADEMIC DISHONESTY

All students are expected to engage in all academic pursuits in a manner that is above reproach. Students are expected to maintain honesty and integrity in the academic experiences both in and out of the classroom. Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. The University and its official representatives may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including but not limited to, cheating on an examination or other academic work which is to be submitted, plagiarism, collusion and the abuse of resource materials. *The use of a programmable calculator on a quiz or exam is considered cheating.*

For a complete listing of the university policy, see:
<http://www.shsu.edu/administrative/faculty/sectionb.html#dishonesty>

CLASSROOM RULES OF CONDUCT

Students are expected to assist in maintaining a classroom environment that is conducive to learning. Students are to treat faculty and students with respect. Students are to turn off all cell phones while in the classroom. Under no circumstances are cell phones or any electronic devices to be used or seen during times of examination.

STUDENT ABSENCES ON RELIGIOUS HOLIDAYS

Students are allowed to miss class and other required activities, including examinations, for the observance of a religious holy day, including travel for that purpose. Students remain responsible for all work. *See Student Syllabus Guidelines.*

STUDENTS WITH DISABILITIES POLICY

It is the policy of Sam Houston State University that individuals otherwise qualified shall not be excluded, solely by reason of their disability, from participation in any academic program of the university. Further, they shall not be denied the benefits of these programs nor shall they be subjected to discrimination. Students with disabilities that might affect their academic performance should visit with the Office of Services for Students with Disabilities located in the Counseling Center. *See Student Syllabus Guidelines.*

VISITORS IN THE CLASSROOM

Only registered students may attend class. Exceptions can be made on a case-by-case basis by the professor. In all cases, visitors must not present a disruption to the class by their attendance. Students wishing to audit a class must apply to do so through the Registrar's Office.

LAB SCHEDULE

Tuesday, Thursday, or Friday, 1:00 – 5:00 in CFS 313

WEEK	BEGINNING ON	EXPERIMENT
1	Aug. 30	Buffer Preparation and Intro to Bioinformatics (Formal Report)
2	Sept. 6	Enzyme Extraction and Bradford Assay
3	Sept. 13	Gel Filtration Chromatography
4	Sept. 20	Protein Separation via SDS-PAGE (Formal Report)
5	Sept. 27	Enzyme Kinetics
6	Oct. 4	Enzyme Kinetics with Inhibition (Formal Report)
7	Oct. 11	Mitochondria Separation and Extraction
8	Oct. 18	Cytochrome C Oxidase Assay (Formal Report)
9	Oct. 25	DNA Purification, Restriction Digest, and Electrophoresis
10	Nov. 1	Polymerase Chain Reaction and Bioinformatics
11	Nov. 8	Plasmid Insertion and Ligation
12	Nov. 15	Bacterial Transformation and Observation (Formal Report)
13	Nov. 29	Substrate Nuclear Magnetic Resonance (Formal Report)
14	Dec. 6	Final Exam

Note: This schedule is tentative and is subject to change

WEEK	BEGINNING ON	EXPERIMENT
1	Aug. 30	Buffer Preparation and Intro to Bioinformatics (Formal Report)
2	Sept. 6	Enzyme Extraction and Bradford Assay
3	Sept. 13	Gel Filtration Chromatography
4	Sept. 20	Protein Separation via SDS-PAGE (Formal Report)
5	Sept. 27	Enzyme Kinetics
6	Ocl. 4	Enzyme Kinetics with Inhibition (Formal Report)
7	Oct. 11	Mitochondria Separation and Extraction
8	Oct. 18	Cytochrome C Oxidase Assay (Formal Report)
9	Oct. 25	DNA Purification, Restriction Digest, and Electrophoresis
10	Nov. 1	Polymerase Chain Reaction and Bioinformatics
11	Nov. 8	Plasmid Insertion and Ligation
12	Nov. 15	Bacterial Transformation and Observation (Formal Report)
13	Nov. 29	Substrate Nuclear Magnetic Resonance (Formal Report)
14	Dec. 6	Final Exam

Brief Description of Experiments and Instruments/Techniques Involved:

Buffer Preparation and Intro to Bioinformatics

How to make a buffer

Use of computers to search for amino acid and DNA sequences

Uses: *Micropipette, pH Meter, Computer*

Enzyme Extraction and Bradford Assay

Extraction of tyrosinase from mushrooms and assay of amount of protein using a Bradford Assay

Uses: *Extraction/Homogenization Equipment (tissue press), UV-vis spectrophotometer*

Gel Filtration Chromatography

Purification of tyrosinase

Uses: *Chromatography columns, sephadex, UV-vis spectrophotometer*

Protein Separation via SDS-PAGE

SDS-PAGE Analysis of purified of tyrosinase

Uses: *PAGE Gels, Gel casting apparatus, vertical electrophoresis chambers, Blot/transfer apparatus for Western Blots, Digital camera for gel documentation*

Enzyme Kinetics

Kinetics of purified of tyrosinase

Uses: *Enzymes, substrates, UV-vis spectrophotometer, Excel*

Enzyme Kinetics with Inhibition

Kinetics of purified of tyrosinase

Uses: *Enzymes, substrates, inhibitors, UV-vis spectrophotometer, Excel*

Mitochondrial Separation and Extraction

Isolation of intact mitochondria

Uses: *Dounce homogenizers, Centrifuge (Differential centrifugation)*

Cytochrome c Oxidase Assay

Measurement of cytochrome c oxidase activity of intact mitochondria

Uses: *Mitochondria, cytochrome c, enzyme assay, maltoside detergents (degradation of outer mitochondrial membrane), Centrifuge, UV-vis spectrophotometer*

DNA Purification, Restriction Digest, and Electrophoresis

Purification of plasmid DNA from bacteria (pVIB from *E. coli*)

Uses: *Bacterial cell lysis, DNA extraction, Centrifuge*

Polymerase Chain Reaction and Bioinformatics

PCR amplification of individual genes (luciferase operon genes in the plasmid pVIB), DNA polymerase based mutagenesis in the study of proteins and enzymes, planning mutagenesis by analyzing sequence on computer

Uses: *Bacterial cell incubators, Polymerase Chain Reaction (PCR) Thermocycler, Computer (Bioedit, Blast, NCBI, etc.)*

Plasmid Insertion and Ligation

Re-integrating PCR product from prior experiments into a plasmid vector for future expression of enzyme in *E. coli*

Uses: *Bacterial cell incubators*

Bacterial Transformation and Observation

Transformation of vector generated in previous experiment into *E. coli*, and observation of resulting luminescence (or lack thereof for some mutations)

Uses: *Bacterial cell incubators, Digital camera (for documentation of luminescing bacteria on agar plates)*

Substrate Nuclear Magnetic Resonance

NMR identification of the substrates and products of the luciferase bioluminescence reaction

Uses: *Bacterial cell incubators, Digital camera (for documentation of luminescing bacteria)*

Instruments: *Nuclear Magnetic Resonance (NMR)*

Organic Chemistry I Laboratory
CHEMISTRY 218 LABORATORY

Fall 2008 2010

1 Credit Hour

Pre-Labs in CFS 103

Sects: 11,12,13,14 Mon 1:00-1:50 PM

Sects: 21, 22, 23 Mon 3:00 – 3:50 PM

Laboratories in CFS 119

Sect 11: Tu 12:00-2:50 PM

Sect 12: We 12:00-2:50 PM

Sect 13: Th 12:00-2:50 PM

Sect 14: Fr 12:00-2:50 PM

Sect 21: Tu 3:00-5:50 PM

Sect 22: We 3:00-5:50 PM

Sect 23: Th 3:00-5:50 PM

Sect 24: Fr 3:00-5:50 PM

Instructor:	Dr. Benny E. Arney	Email:	CHM_BEA@SHSU.EDU
Office Phone:	294-1531 off-camp ext. 41531 on-camp	Office:	CFS 326 Or CFS 305 Or CFS 323
Website	Blackboard at www.shsu.edu	Office Hours:	MW : 9:00-9:50 AM TTh : 8:30-10:0 AM

Prerequisites:

Completion of CHM 139 and CHM 119 with grades of C or higher and concurrent enrollment in CHM 238 or prior completion of CHM 238 with a grade of C or higher.

Required Texts:

- (1) Chemistry 218 Laboratory Manual,
- (2) "The Organic Chem Lab Survival Manual" by Zubrick (isbn 0-471-12948-8) and
- (3) Your Organic Chemistry Lecture Text.

Required Supplies:

- (1) Laboratory Research Notebook with perforated duplicates.
- (2) DEPARTMENT APPROVED SAFETY GOGGLES
- (3) Black or blue non-erasable pen for writing in notebook.

Suggested Supplies:

- (1) a small container of a good grease-cutting dish-soap.
- (2) latex or neoprene gloves to protect hands.

- (3) a black "SHARPIE" marker to label your glass while in use.
- (4) Lab coat, to protect body and clothing.

Non-erasable pens (**BLUE or BLACK ONLY**) must be used for all laboratory work entries. Pencil or white-out are not acceptable and a minimum of 20% will be deducted from each laboratory for which they are used. Erasures will also cost an additional 20% of possible points for that experiment.

Important NOTICE!!!

Organic Chemistry Lab requires attendance of a Pre-Lab on Monday afternoon:

Sect: 11, 12, 13, 14

Monday 1:00-1:50 PM

Sect: 21, 22, 23, 24

Monday 3:00-3:50 PM

In this Pre-Lab session the laboratory quiz will be given, and the laboratory preparation and instructions for the next experiment will be given. If you do not attend the Pre-lab for which you are scheduled, you will receive a zero for the lab quiz portion of the experiment.

Cell Phones must be turned off during class and may not be used in the lab.

If your cell goes off in class, you **will** be ejected from the classroom. No ear mounted phones or ear phones (i-pods) are allowed in class. You are not allowed to use cell-phones or computers during laboratory. If you are caught making or receiving calls, IM, e-mails, texts, etc. during lab you will be ejected, your experiment shut down, and receive a zero for that lab's grade.

NO use of electronic devices is allowed during lab without the written documentation from the Office of Student with Disabilities.

Acceptable Attire:

In the laboratory, shorts and open-toed shoes are unacceptable and will not be allowed. Long hair must be tied back and loose flowing clothing is highly discouraged. These are your safety and not for your convenience. We are thinking of your safety even if you are not.

Attendance:

Attendance is required at each scheduled laboratory Pre-lab and session since each experiment will only be performed during the week it is scheduled and cannot be made-up. However, life is not always flexible so the lowest lab grade will be replaced by the percentage grade on the Laboratory Final. If you miss a lab session that will be the one replaced by the percentage grade on the Laboratory Final. Additional missed

laboratory sessions will be recorded as zeros. **Late work will not be accepted** and the grade for that lab will be a zero.

Check-In & Check-Out:

At the first scheduled (Week of Sept 13) meeting of the in-laboratory class, each student will be assigned a lab cabinet and drawer containing equipment to perform the experiments scheduled for the semester. During this time make sure to examine each piece of glassware for chips, cracks, and breaks for your own safety and so that you will not be charged to replace it later. Make a note of any missing equipment on the check-in sheet provided in the Lab manual.

After you have "checked-in", you are responsible for the equipment in your cabinet, so do not leave it unlocked as one can rarely assume their neighbors are as conscientious as they are.

If you decide to drop the lab, resign from the University, or finish the course after you have checked-in then you must "check-out" with your TA. During "check-out" the cabinet is inventoried against the "check-in" sheet. If you do not "check-out", the TA will check-out the cabinet and you will be charged a \$25 Check-out Fee plus the cost of any missing or damaged items that were placed in your care.

Preparation for the Pre-Lab

Before coming to Pre-lab, you must prepare for the lab quiz, to perform the experiment, set up your lab notebook, and read and study any assigned or necessary materials.

(1) Check schedule of experiments to find out which experiment is to be performed and any additional requirements.

(2) Read the experimental description from the lab manual and any appropriate sections in the Zubrick book covering techniques to be used in the experiment.

(3) Set up your lab notebook as described below. Experiment #1 does not need this step.

NOTE: You will not be allowed to bring your lab manual to lab after Experiment #1. The only personal items allowed in the laboratory are your notebook, Zubrick, calculator, and blue/black nonerasable pen. If you bring your lap-top computer or other electronics to lab, you are responsible for them and their loss, damage, destruction, or theft are your responsibility alone.

In Pre-Lab:

An overview of the next experiment will be given covering the important aspects of the experiment, as well material on spectroscopic analysis. Periodically, problem sets covering spectroscopic analysis will be given out that will be due at the next Pre-lab.

A quiz will be given that covers the previous experiment, the general details of the coming experiment, and the techniques used in the experiments, spectroscopy, and lab safety.

In Lab:

- (1) Upon entering the lab, turn in the copy sheets from your pre-lab write-up and the completed lab write-up from the previous week's lab.
- (2) Come to lab ready to work. There are only three hours available to work and no more. If you have not completed your work in the allotted time, the experiment will be shut down and points will be lost.
- (3) Work safely.
- (4) As the experiment progresses, clean any used equipment and glassware before putting it away in your drawers. **NEVER PUT DIRTY GLASSWARE AWAY.** Make sure all of your equipment is put away before leaving. Any equipment left out in the laboratory will be returned to the stockroom for redistribution and you will be charged for any missing equipment. 10% for each piece of glassware left out will be deducted from the grade for the lab experiment being conducted.

Schedule of Experiments:

Pre-Lab	Lab week	Experiment #	Pre-Lab Title
Aug 30: Pre-lab Only		Overview of Lab requirements and Expectations: Notebook setup, report format, in lab behavior, handling of equipment and glass.	Lab Safety and Procedures
Sept 13	Sept 13	Exp. 1: Building molecules: using molecular model kits, build 3D structures from the 2D depictions of Lewis, condensed, and line-angle formulas, observe rotation of single bonds, fluxionality of rings, chirality, etc.	1. Check-in, 2. Molecular models and 3. Functional Groups (preparing to introduce Infrared Spectroscopy)
Sept 20	Sept 20	Exp. 3: Recrystallization and melting point determination: Read Sections of Zubrick covering Recrystallization. Recrystallization as a purification method, selection of appropriate solvent, steps and techniques including fluted-paper filtration, vacuum filtration, melting point determination and percent recovery calculation. Spectroscopy:	1. Recrystallization Experiment (Lab) and 2. Introduction to IR-Spectroscopy (Pre-lab) Before lab begin reading and studying Chapter 12 of Organic Text.

Sept 27	Sept 27	<p>Exp. 2: Acid-Base Extraction Read Sections of Zubrick covering Extractions + Explores the use of acid-base properties of solutes in order to control water solubility by conversion to the charged conjugate acid or base. Used to separate a mixture of organic compounds.</p>	<ol style="list-style-type: none"> 1. Acid-Base Extraction Techniques & 2. IR Spectroscopy and Problems
Oct 4	Oct 4	<p>Preparation of an alkyl acetate PowerPoint Instructions available on BlackBoard + Read section of Zubrick covering reflux of reactions. Uses a simple reaction to introduce the use of the reflux technique and the application of extraction to the work-up of a reaction mixture to isolate the desired product.</p>	<ol style="list-style-type: none"> 1. Preparation of an alkyl acetate & 2. Introduction to Nuclear Magnetic Resonance (NMR) Before lab read and study Chapter 13 of Organic Text.
Oct 11	Oct 11	<p>Exp. 4 Distillation: Read Sections of Zubrick covering Distillation, theory, simple and fractional distillation Setting-up, and performing a simple and a fractional distillation. Observation of boiling point behavior and mixture separation.</p>	<ol style="list-style-type: none"> 1. Distillation & 2. Intro. To NMR cont'd
Oct 18	Oct 18	<p>Exp. 5 Dehydration of Cyclohexanol: Application of distillation to push a reaction to completion and purify the expected product. Tests for unsaturation (Baeyer test, Br₂)</p>	<ol style="list-style-type: none"> 1. Dehydration of Cyclohexanol & 2. Intro. To NMR cont'd
Oct 25	Oct 25	<p>Exp. 6 Preparation of n-Bromobutane: Fractional distillation from a reaction mixture and extraction of distillate for purification.</p>	<ol style="list-style-type: none"> 1. Preparation of n-Bromobutane & 2. Overview and working of NMR Problems

Nov 1	Nov 1	Exp. 10 Synthesis and Purification of Aspirin: Use of reflux to prepare a solid. Recrystallization and extraction for purification. Acidity of carboxylic acids and phenols and FeCl ₃ test for phenols	1. Synthesis and Purification of Aspirin 2. Spectroscopy Problems
Nov 8	Nov 8	Clean-up & Check-out	
Nov 15	Nov 15	Lab Final,	Lab Final
Nov 29	Nov 29		

Notebooks:

Except for Experiment #1. Prior to coming to the Pre-lab, the notebook must be prepared for conducting the experiment as outlined below. This is necessary, because you will not be allowed to bring the lab manual into the laboratory. You must perform the experiment using only your notebook and any additional instructions given in the pre-lab.

- I. First Page of Notebook with Name and Table of Contents.
 - a. Name and ID # at the Top.
 - b. Table of Contents to show

Page	Experiment Title
------	------------------
- II. For each Experiment
 - a. Title
 - b. A one or two sentence summary of the Experiment.
 - c. If a reaction is to be performed, the reaction should be shown using complete structural formulas.
 - d. Reagent table as follows: should include all reagents used in the experiment, MSDS sheets and chemical supply catalogs will available in the laboratory for gathering information needed. It is best to look up the information the week before.

Reagent	Formula	Mol. Wt.	mass or vol	mmoles	Cautions, Notes
sodium hydroxide	NaOH	40.0	5.0 g	125	Caustic, strong base

- e. Outline of experimental procedure with sufficient detail to actually perform the experiment. This is very important since the lab manual is not allowed in the laboratory.

In the Laboratory

a. Describe your actual procedure. The true amounts of materials weighed out and equipment used. Include any observations such as temperature or color changes. For example:

“I weighed out 4.98 g of NaOH pellets and placed them into a 100 mL single-neck boiling flask. Two boiling chips were added to the flask with 25 mL of water. The dissolved NaOH was very warm, ...

b. Calculation of percentage yield (if you don't remember how find it in your freshman text, Chap 3 or 4).

c. Discussion & Conclusion: Write your interpretation of the observations and results obtained during the laboratory. Why was the yield good or bad? Was the results what you expected? Et cetera.

d. Answers to questions for the experiment.

Grading: For each Lab a grade will be computed as follows:

First Lab: successfully checking-in and going through the Lab Handout =
Attendance x (checkin and completion of Handout)
(0 or 1) x 10

Others: (note: reports for Exp. 9&10 are turned-in together.
Attendance x (Quiz(4pts) + Report(6pts)) = Grade
(0 or 1) x (4 + 6) = max of 10

Problem Sets: 10 points@.

The total of the labs make up 60% of lab grade.	60%
Problem Sets	10%
Lab Final (comprehensive) will count 30%	30%
	100%

A≥90%, B≥80%, C≥70%, D≥60%, F≤59%

The report for each experiment will consist of the yellow duplicate sheets from your laboratory notebook with any additional questions from the experiment included in the notebook. This report will turned in at the beginning of the very next Pre-lab after completion of the experiment. Every experiment must have a conclusion as part of its write-up and report.

The final examination for the laboratory will be comprehensive and will focus on the experience of the laboratory. That is; how is this done?; what should this appear like?; how do I set up this operation?; et al. Know your basic laboratory common sense. What tests are for what? What does a positive result for this or that test mean or look like? Fundamentals of spectroscopy? Remember to pay attention in the lab and record all of your observations in your notebook. Good-Luck.

Treat your laboratory experience like a romantic date and pay attention to what is going on and not just worry about how soon can I get out of

here!! Focus on understanding what and why you are doing the procedures that you are performing and “what did they look like?”.
Remember: If you do not know what you are going to be doing before you get to lab, you probably will not know what you did or did not do when you leave.

SAM HOUSTON STATE UNIVERSITY

Experiment List for CHM 448
Physical Chemistry I
Fall 2010

Laboratory Topics and Equipment

1. Numerical Solutions of the Schrodinger Equation using Microsoft Excel
2. Molecular Symmetry, Point Groups, and Group Theory using Model Kits and Gaussian 03w
3. Computational Chemistry and Molecular Simulations using Gaussian 03w
4. Numerical Solutions of the Transition Dipole Moment and Symmetry Selection Rules using Microsoft Excel
5. Vibrational Spectroscopy and Molecular Symmetry using IR, Raman, and the Correspondence Principle
6. The NIST Atomic Spectral Database using Visible Atomic Emission Spectroscopy
7. Standard Color Spaces and Colorimetry using Visible Transmission and Reflectance Spectroscopy
8. Scientific Paper Writing Workshop using Microsoft Word
9. The Rovibronic Spectroscopy of Molecular Iodine using Gas-phase Visible Spectroscopy

List of Laboratories with the instruments used in
Quantitative Chemical Analysis: Laboratory, CHM 241
David E. Thompson - Spring 2011

Lab 1: Formulas, Plots and Basic Statistics in Microsoft Excel

Instruments used: Computer

Lab 2: Error Bars and Statistical Testing in Microsoft Excel and on Graphing Calculators (e.g. TI-84)

Instruments used: Computer, Graphing Calculators

Lab 3: Entering and using the formulas for Linear Least Squares Regression in Microsoft Excel

Instruments used: Computer

Lab 4: UV-VIS Spectrophotometric Determination of Iron

Instruments used: UV-VIS spectrophotometer, Analytical Balance, Computer

Lab 5: Determination of Calcium in a Vitamin Pill by Atomic Absorption Spectroscopy

Instruments used: Atomic Absorption spectrophotometer, Analytical Balance, Computer

Lab 6: Preparing and Standardizing a Sodium Hydroxide Solution

Instruments used: Analytical Balance, Volumetric Glassware, Micropipettes

Lab 7: Determining the Weight Percent of an Unknown Acid via Titration with Aqueous NaOH

Instruments used: Analytical Balance, Volumetric Glassware, Micropipettes

Lab 8: Iodometric Determination of Vitamin C in a Vitamin Tablet

Instruments used: Analytical Balance, Volumetric Glassware, Micropipettes

Lab 9: Preparing and Challenging a Buffered Solution – Testing Acid Base Calculations

Instruments used: pH meter, Analytical Balance, Volumetric Glassware, Micropipettes

Lab 10: Introduction to temperature programming and qualitative analysis on the GC-FID

Instruments: GC-FID, Volumetric Glassware, microsyringes

Lab 11: Quantitative analysis of decane in hexane using dodecane as an internal standard

Instruments: GC-FID, Volumetric Glassware, microsyringes, Computer

Course Information

- Darren L. Williams, Ph.D. (a.k.a. DW)
 - Office: CFS 317 G, Office hours are 10 to 11 AM, MTWTF, and other times by appointment. Email is the preferred method for making appointments.
 - Contact (936)294-1529, williams@shsu.edu, http://www.shsu.edu/~chm_dlw/, and www.facebook.com/pchem4all
- Lecture will meet in CFS 121 on Monday, Wednesday, and Friday from 8 to 9 AM.
- The laboratory will be open on Monday and Wednesday from 1 to 5 PM. We will meet in different locations throughout the semester (CFS 235, CFS 313, CFS 321, and a campus computer lab to be named later).
 - Lab attendance is required on only one of these days each week.
 - A **binding** lab schedule will be developed in the first 2 weeks of the semester.
 - The lab meeting place will be announced in class each week.

Course Description

The foundations of thermodynamics and spectroscopic methods (radio-frequency, microwave, infrared, Raman, UV-visible, and X-ray) are developed from first principals with an atomistic point of view.

- Four-hour laboratory. Writing Enhanced. Fall. Credit 4.
- Prerequisites: A minimum grade of C in CHM 239, MTH 143 and one year of physics.

Course Objectives

The main course objectives are:

- IDEA Objective #2: To learn fundamental principles, generalizations, and theories.
- IDEA Objective #8: To develop skill in expressing oneself orally or in writing.

Enabling Objectives direct student effort toward the course objectives. The students will be exposed to and demonstrate some mastery of:

- Experiments that demonstrate the need for the theory of quantum mechanics.
- The mathematics associated with basic quantum theory.
- Spectroscopic measurements to determine physical constants.
- The use of symmetry operators to interpret spectroscopic measurements.
- The use of computational chemistry programs that aid the chemist in the above objectives.
- The use of Microsoft Excel for numerical integration, non-linear equation modeling, and spectral simulation.

Table 1: Numerical Average Weighting Factors

Category Scores (0 – 100%)	Weighting Factor
Attendance Score	0.05
Homework Average	0.10
Exam Average (includes final)	0.60
Laboratory Average	0.25

Table 2: Attendance Grading Scheme

Number of Absences	Attendance Score
1 to 3	100%
4	80%
5	60%
6	40%
7	20%
8 or more	0%

Required Textbook

Quantum Chemistry and Spectroscopy 2nd Ed., by Engel and Reid, Pearson – Benjamin Cummings, New York, 2003 (ISBN-0-3216-1504-2) If taking both semesters, you may wish to buy the larger edition that contains the fall and spring books in one volume: Physical Chemistry 2nd Ed, (ISBN-0-3216-1505-0)

Grading Scheme

The numerical average will be computed according to the weighting factors in the Table 1. Specific letter grade cut-off values are not predetermined because of the semester-by-semester variation of exams, classes, and circumstances. To determine the course letter grade, the student's numerical average will be compared to course requirements, to peer performance, and to the definitions set forth in the University Catalog (<http://www.shsu.edu/catalog/scholasticrequirements.html>) where average performance is a minimum of a C letter grade.

Attendance Policy

In accord with university policy, students will not be penalized for absences of up to three hours as long as examinations and other assigned work have not been missed. Table 2 explains the attendance score. The student is responsible for signing the roster at the beginning of each class period.

Forgetting to sign the roster is equivalent to an absence.

Homework Assignments

Homework assessment will take place on Blackboard. Print the pdf of the homework assignment. Do the problems, and then enter your answers on Blackboard. You only get TWO ATTEMPTS to enter your answers, so take it seriously. Don't procrastinate. Most of the exam material will come from modified Blackboard homework problems. One or two exam questions will come from the suggested "A-level" problems.

Assignments are due BEFORE CLASS ON THE DUE DATE. The gradebook in Blackboard will be updated after each exam. At that time, Dr. Williams will change the most recent homework grades to the most recent exam grade if the exam

grade is higher. *In general, your homework grades can be higher, but not lower than your exam grades.* However, unattempted homework will receive a grade of zero.

Exams

The exam schedule will be continually updated throughout the semester on Blackboard. **BRING A SCANTRON 882-E and a pencil to each exam.** The exams and scantrons will remain the property of SHSU as a record of student performance. The students are welcome to compare their exams to the key in DW's office.

DW does not give make-up examinations. In the unfortunate case, where a student misses an exam, DW will discuss possible remedies with the student provided that all the following conditions are met:

1. The student was absent on the exam date.
2. The student telephoned in advance or left a voice mail message or email message alerting Dr. Williams to their absence along with a description of why they are to miss the exam. (All information will be kept in confidence.)

DW reserves the right to modify the grading scheme such that the final exam may compensate for the missed exam course percentage. DW also reserves the right to assign an exam grade of 0% should he deem the absence was not properly handled or was unjustified. Appeals will be handled in accord with University Policy Statement 900823, Academic Grievance Procedures for Students.

The 2-hour final **comprehensive** examination will be on Monday December 13, 2009 from 8 to 10 AM. The schedule is posted here (<http://www.shsu.edu/students/finalexam.html>). Tell your family and friends that you CANNOT leave town early for vacation or work or leadership conferences or rodeo finals or anything. **Modify your plans NOW to fit your academic schedule.** The final exam will be weighted equally with the other exams in computing the exam average.

Laboratory Work

The number of lab experiments and the requirements for lab reports will be provided on Blackboard as the semester progresses. The extensive writing component of this course is present in the laboratory reports. Grammar and writing style will be included in the grading scheme for each report.

The top priority for laboratory work is SAFETY! Safety glasses or goggles MUST be worn and aprons or lab coats are encouraged when doing wet chemistry or cleaning glassware. If the actions of any student are deemed to be unsafe and hazardous, the student will be removed from the laboratory, and an appointment will be made with the department chair to evaluate a course of action. The second priority for laboratory work is CLEANLINESS. All the students are responsible for keeping the whole laboratory clean. DW will deal fairly and firmly with any students who consistently make this task difficult for their peers. The third priority for laboratory work is PRODUCTIVITY. **The names of students who leave lab early will be recorded by the TA, and these students will not receive any further help from the TA or DW in completing their assignments.**

Students taking this course for graduate credit are to choose one laboratory experiment that needs improvement, and prepare an improvement package that is suitable for use in future laboratory sections. This assignment will be graded and will account for ten percent of the weighted numerical average.

Employment Recommendations

For Your Information: Dr. Williams will not write recommendation letters for students who do not make a B or better unless there is some very unusual reason to do so.

Academic Dishonesty

Any student found guilty of dishonesty in any phase of academic work will be subject to disciplinary action. The University may initiate disciplinary proceedings against a student accused of any form of academic dishonesty including, but not limited to, cheating, plagiarism, and the abuse of resource materials. DW reserves the right to ask for an oral explanation of work submitted to determine if the student actually performed the work. This should not be construed as an accusation of academic dishonesty. Only in cases where the student cannot demonstrate the most basic explanation of what they submitted as their original work will there be any question of dishonesty. If DW or the TA believes that a homework assignment or laboratory report is a copy of another person's work, BOTH copies will receive a grade of 0%, and disciplinary action will be considered.

Additional Disclaimers: Rules of Conduct Cell phones must be turned off before class begins. Students are prohibited from text messaging, emailing, Facebooking, or engaging in any other form of distraction. Students who are especially disruptive will be asked to leave and may be reported to the Dean of Students for disciplinary action. **Americans with Disabilities Act:** No disability accommodations can be made until the student registers with the Counseling Center. **Visitor Policy:** Dr. Williams will decide whether or not visitors will be allowed to remain in the classroom. **Religious Holidays** University policy (APS 861001) and state law (Section 51.911(b), Texas Education Code) require that a student who is absent from class for the observance of a religious holy day fill out form (see APS 861001) in the first week of class. This form must be signed by the instructor, the student, and approved by the departmental chair. **Course Material Copyright ©2010** Course material is reserved to Sam Houston State University, and may not be mass-produced, posted online, sold, or reproduced for purposes other than personal use by students registered for this course in the current semester.

Experiment List for CHM 448
Physical Chemistry I
Fall 2010

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7. Standard Color Spaces and Colorimetry using Visible Transmission and Reflectance Spectroscopy
8. Scientific Paper Writing Workshop using Microsoft Word
9. The Rovibronic Spectroscopy of Molecular Iodine using Gas-phase Visible Spectroscopy

Chemistry 426

Advanced Integrated Laboratory Techniques

EXPERIMENTS

Spring 2011

Report Format :

Each experiment will have a different report with different requirements. Most of these procedures include specific report elements that must be included. However, all reports will share these common elements:

1. Short introduction to explain the nature and goal of the experiment.
2. **Brief** but accurate discussion of relevant theory and/or the procedures used to performed the experiment. In the case of a synthetic experiment, outline the synthetic approach utilized.
3. Discussion (Presentation) of the Results:
 - a. discuss how each reaction (measurement) is performed and discuss any problems that arose.
 - b. include the important measurements and their significance and/or problems.
 - c. discuss how each result is calculated. (an example is often helpful)
 - d. most importantly, discuss the significance of the results obtained in terms of the system under study.
4. Experimental Section:
 - a. use the Journal of Organic Chemistry Experimental Section as a model for laboratory procedures.
5. Experimental Notebook Copies.
 - a. the copy pages from your laboratory notebook for the experiment.
 - b. It is imperative that it be clear that the experiment can be reproduced in the lab by a third person using only these sheets and that all data necessary had been recorded during the execution of the experiment.
6. Answers to experimental Problems.
 - a. each experiment has a set of questions and problems that may require some significant pencil on paper or library work to solve.
7. Interpretation of any spectra required or requested as part of the experiment. It should consist of at least a copy of the spectra with structural assignments for the major spectral features shown indicated with a structural drawing.

Those reports for experiments out of *Angelici* should include the items specifically stated in the experiment REPORT section. Any additional components for a report will be indicated with the experimental description.

!!!!!!! Important Dates !!!!!!! :

A report is required from each person by each date specified below. The report must be handed to me (Dr. Arney) on or before **NOON** of the date. After the date, 20% per School Day will be deducted from any potential grade. After five days it is a zero.

Feb. 22, Mar. 20, Apr. 10, May 1, the last before the scheduled final time. **NO WORK WILL BE ACCEPTED AFTER THE SCHEDULED FINAL EXAM TIME.**

ADVISE:

- (1). It is to your advantage to attempt to perform two or more experiments concurrently as most will have significant waiting periods which could be utilized for other experiments and work-ups.
- (2). Prior to lab you must obtain an acceptable procedure for the experiment, from the indicated sources, and prepare to perform the experiment by studying and understanding the operations involved and the nature and handling of the materials to be used.
- (3). The multi-step synthesis is best started as early as possible and performed concurrently with other experiments.
- (4). You will not be "*prepped*" for each lab and are responsible for having the appropriate procedures and knowing the proper use of equipment. However, potentially hazardous operations will be monitored and **NEW** procedures, such as vacuum distillations will be discussed and demonstrated as necessary.
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Experiments to be Performed: .

1. **‡Stability Constants of Ni(glycinate)_n⁽²⁻ⁿ⁾⁺**. Handout procedure based that found in *Angelici*(exp 22). Determination of the stability constants for the complexation of Ni²⁺ ion by glycine as a bidentate ligand. **In addition to the regular report format**, the data and calculations must be neatly and clearly set-up in an MS-Excel Spreadsheet which will be turned in with the report via e-mail attachment.
2. **Inorganic Syntheses: Acetylferrocene & Manganese(III) acetylacetonate** Preparation of acetylferrocene by Friedel-Crafts acylation and purification by column chromatography. Paramagnetic Mn(acac)₃ is prepared by treating KMnO₄ with acetylacetone. The symmetry and fluxionality of the ferrocene rings and the magnetic susceptibility of Mn(acac)₃ are characterized via NMR techniques.
3. **‡Kinetics Investigation of the Nucleophilic Aromatic Substitution Reaction:** Spectrophotometric measurements of the reaction of piperidine with 2,4-dinitrochlorobenzene will be utilized to determine the rate constant of the reaction at several temperatures and the thermodynamic properties of the transition state will be calculated to gain a better understanding of the rate-determining process.
4. **‡Multistep Organic Preparation with Stereochemical Assignment Based on Calculated NMR Parameters.** Indene will be methylated to give 1-methylindene. Hydroxylformylation of the 1-methylindene gives four major products, one of which

will be isolated as a pure single diastereomer. Hydrolysis of the product gives a glycol whose stereochemistry will be assigned based comparison with calculated NMR chemical shifts and coupling constants obtained from the Gaussian03W software. For each isolated compound a complete set of high-field NMR spectra will be obtained including 2D correlation spectra such as COSY, DQF-COSY, HMQC.

5. **‡Hückel Molecular Orbital Computational Lab.** Introduction to the theory and application of Hückel MO theory is covered in some illustrative but revealing cases. Provides some introduction to the use of matrix methods and systems of equations. This is a “dry“ laboratory focusing on the enhancement of mathematical skills and understanding of theoretical applications.
6. **‡Approximate Solution of the Hydrogen atom Numerical Methods by Spreadsheet.** The wavefunction for the one electron hydrogen atom is approximated by a linear sum of four Gaussian functions and its coefficients are optimized by solving the Schrodinger equation for the best energy. This lab focuses on introducing the numerical matrix methods utilized in *ab-initio* software and becoming familiar with much of the non-obvious aspects of MO work. Application of the derived approximate wavefunction will be compared to the exact wavefunction. Matrix-LinAlgebra add-in for Excel, allows us to focus on the general methods more clearly.
7. **‡Chemometrics of Aqueous Metal Ion Mixtures using Least Squares Analysis and the Moore-Penrose Matrix.** Introduces the use of whole spectra for the quantitation and identification of the UV/Vis active metal ions in an aqueous mixture. The linear least squares (LLS) method is applied to spectra, which are treated as a collection of absorbance at distinct wavelengths. The equivalence of the Moore-Penrose Pseudo-Inverse matrix to the LLS method is shown in theory and practice.

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Chemistry 426

Advanced Integrated Laboratory Techniques

EXPERIMENTS

Spring 2011

Report Format :

Each experiment will have a different report with different requirements. Most of these procedures include specific report elements that must be included. However, all reports will share these common elements:

1. Short introduction to explain the nature and goal of the experiment.
2. **Brief** but accurate discussion of relevant theory and/or the procedures used to performed the experiment. In the case of a synthetic experiment, outline the synthetic approach utilized.
3. Discussion (Presentation) of the Results:
 - a. discuss how each reaction (measurement) is performed and discuss any problems that arose.
 - b. include the important measurements and their significance and/or problems.
 - c. discuss how each result is calculated. (an example is often helpful)
 - d. most importantly, discuss the significance of the results obtained in terms of the system under study.
4. Experimental Section:
 - a. use the Journal of Organic Chemistry Experimental Section as a model for laboratory procedures.
5. Experimental Notebook Copies.
 - a. the copy pages from your laboratory notebook for the experiment.
 - b. It is imperative that it be clear that the experiment can be reproduced in the lab by a third person using only these sheets and that all data necessary had been recorded during the execution of the experiment.
6. Answers to experimental Problems.
 - a. each experiment has a set of questions and problems that may require some significant pencil on paper or library work to solve.
7. Interpretation of any spectra required or requested as part of the experiment. It should consist of at least a copy of the spectra with structural assignments for the major spectral features shown indicated with a structural drawing.

Those reports for experiments out of *Angelici* should include the items specifically stated in the experiment REPORT section. Any additional components for a report will be indicated with the experimental description.

!!!!!!! Important Dates !!!!!!! :

A report is required from each person by each date specified below. The report must be handed to me (Dr. Arney) on or before **NOON** of the date. After the date, 20% per School Day will be deducted from any potential grade. After five days it is a zero.

Feb. 22, Mar. 20, Apr. 10, May 1, the last before the scheduled final time. **NO WORK WILL BE ACCEPTED AFTER THE SCHEDULED FINAL EXAM TIME.**

ADVISE:

- (1). It is to your advantage to attempt to perform two or more experiments concurrently as most will have significant waiting periods which could be utilized for other experiments and work-ups.
- (2). Prior to lab you must obtain an acceptable procedure for the experiment, from the indicated sources, and prepare to perform the experiment by studying and understanding the operations involved and the nature and handling of the materials to be used.
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