Analytical Chemistry Laboratory  
CHEM 3143-A and CHEM 3143-B  
Fall 2016

Instructor 1: Dr. Richa Chandra, Assistant Professor  
Office: Robertson B111  
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Instructor 2: Dr. John Palasota, Professor and Chair  
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Phone (713) 525-6918

Office hours: Please see Blackboard for posted office hours.  
If you cannot make it to scheduled office hours, please email to set up an appointment.

CLASS MEETING:  
Laboratory: A: Wednesday 1:10-5 PM OR B: Thursday, 1:10-5 PM, Robertson 204W  
Laptop, tablet and/or smart phone use is NOT PERMITTED in the laboratory!

COREQUISITE: CHEM 3343; PREREQUISITE: CHEM 1341, 1342

COURSE MATERIALS:  
1. Student Web Site: www.whfreeman.com/qca8e for laboratory experiments - FREE (required)  
2. Laboratory Composition Notebook (required)

COURSE DESCRIPTION: Analytical Chemistry Laboratory is a course that accompanies the lecture.  
In this course, we will focus on developing laboratory competence in analytical skills including the  
separation, identification and quantification of various analytes. You will also become proficient at  
analyzing laboratory data using statistical methods and calibration methods. We will examine the  
principles of solution equilibria and survey the more commonly used instrumental techniques. It is  
critical to remember that all analyses are performed in the lab. The end of this course will culminate in  
individual projects that will involve surveying scientific literature to design and execute your own  
experiments. You will apply the tools you have learned to perform these experiments and write a report  
and present your work to your peers.

LEARNING OUTCOMES: Students will  
• learn to apply course materials (to improve rational thinking, problem solving and decisions),  
• develop specific skills, competencies and points of view needed by professional analytical  
chemists,  
• learn how to find and use resources for answering questions or solving problems,  
• acquire skills in working with others as a member of a team,  
• and develop skills in expressing oneself orally or in writing.

More specifically, students will practice and develop proficiency with  
• hypothesis-driven preparation of advanced laboratory experiments,  
• the proper and safe use of laboratory equipment and supplies,  
• sample preparation, measuring techniques and calibration methods,  
• statistical analysis of laboratory data,  
• critical scientific thinking and analytical reasoning skills to make scientific conclusions,  
• various instrumental techniques of analysis including electrochemistry, spectrophotometry, and  
chromatography,  
• and experimental design and dissemination of analytical statistical data and conclusions through  
formal report writing and formal presentation.
GRADING: The percent contribution of each type of assignment, participation, and exams to the final grade is shown below. For further descriptions of each category, see below.

<table>
<thead>
<tr>
<th>Assignment/Exam</th>
<th>Contribution to Final Grade</th>
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<tbody>
<tr>
<td>Pre-Lab Quizzes</td>
<td>10 %</td>
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<tr>
<td>Laboratory Performance</td>
<td>15 %</td>
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<tr>
<td>Laboratory Reports</td>
<td>35 %</td>
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<tr>
<td>Project Proposal</td>
<td>10 %</td>
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<tr>
<td>Formal Project Presentations</td>
<td>15 %</td>
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<tr>
<td>Formal Project Report</td>
<td>15 %</td>
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Final letter grades will then be determined by calculating the percentage points earned compared to the total number of points possible, and grades will be assigned on the following scale. Final letter grades may be reported with a plus or minus.


PRE-LAB QUIZZES: Before you begin the experiment and before my pre-laboratory lecture, you will have 10 minutes to take a short quiz that will test you on the general principles of the experiment for that day and more detailed questions from the previous experiment.

LABORATORY PERFORMANCE: During the lab period, you will be evaluated and graded on your laboratory performance in terms of appropriate lab attire, timeliness, safety, laboratory skills, preparedness for the experimental procedure, cleanliness and respect for your classmates, the common areas in the laboratory and your personal work space. Your pre-lab write up should be complete before you enter the classroom. I will check laboratory notebooks as you begin your experiments. I will grade you on the format of your notebook (see Blackboard handout on Laboratory Notebook Format) including the Table of Contents, page numbering, proper titling, and page numbering. I will also evaluate your Statement of Purpose, Materials, and Experimental Procedure for completeness and correctness. Everything in your lab notebook should be written in INK! When adding your Excel reports to your notebook at the conclusion of an experiment, you must tape or paste in the additional pages. Each page should be included separately. Do not staple or fold in any sheets into the notebook. Both in the middle (unannounced) and at the end of the semester, I will collect your lab notebooks to assign you a grade on proper formatting and content. This will be worth half of your laboratory performance grade.

LABORATORY REPORTS: Each experiment will have an associated Excel report that will be due by the following week after an experiment is concluded. A detail on what is included in each report is provided on the laboratory handouts on Blackboard. Late work will not be accepted.

PROJECT PROPOSAL: Each project team will collectively prepare a project proposal based on a thorough examination of the primary literature (preferably ACS journals) based on the quantitative experiment selected. The proposal must be detailed and include a statement of purpose; a materials table, which includes ALL chemicals required for the experiment, the vendor (Sigma-Aldrich, Fisher Price, or VWR), quantities required, and price; and a detailed experimental plan or procedure.

FORMAL PROJECT PRESENTATIONS: Each team (2-3) of students must formally present their work to the class utilizing PowerPoint or other presentation software as well as evaluate their peers.
will be evaluated on your presentation skills, critical scientific thinking, statistical data analysis, and your scientific conclusions. In addition, I will also evaluate you on your ability to engage in presentations given by your peers in terms of the questions you ask and your attention to the science behind others’ experiments. Half of your grade will come from assessment by the audience, and half of it will be based on my assessment.

**FORMAL PROJECT REPORT:** After completion of project experimentation, each student will individually submit a formal report that needs to be typed, double spaced, and 12 point Times New Roman font. The report should include the following sections.

1. **Title Page** (5 points)
2. **Abstract** (5 points): This is a short paragraph that will include your statement of purpose, a summary of the results, and conclusions drawn from the experimentation. Look at ACS publications such as *Analytical Chemistry* for examples.
3. **Background** (2-3 pages, 20 points): This section will provide the backdrop for the project. It will include the theories behind the experiments, the principles of the techniques used and the relevance and scope of the purpose, which should be restated here. This is the section where you show that the project was meaningful and has some tangible impact. It does not have to be limited to the immediate experiment but to the general topic of the experiment. All ideas that are not original should be properly referenced (see the ACS Style Guide).
4. **Materials and Method** (10 points): In this section you will provide a list of the chemical materials used and where they were purchased. You will then briefly describe the experimental procedure. If you used a published procedure, make sure you properly reference it. Any specialized instrumentation should be included in the procedure along with the manufacturer. Please see ACS publications as a guideline.
5. **Data and Results** (20 points): In this section you will present all relevant Data (in tabular formal) and Figures. All data should be reported here prefaced by statement(s) that describe the data prior to its appearance in the report.
6. **Discussion** (30 points): In this final section, you will summarize the data and results and discuss the statistical significance of the results. Based on this analysis, you will make with concluding statements in light of achieving the statement of purpose. You should again discuss the impact of the work and indicate future directions.
7. **References** (10 points): List all resourced and use proper ACS formatting. Include at least three references from peer-reviewed journals, two that should be ACS publications.

**ELECTRONIC RESOURCES:** Laboratory handouts as well as additional online resources for this class will be posted on Blackboard. You are required to check your Blackboard account and UST email for such information and other important announcements for the class daily.

**ACADEMIC HONESTY:** I expect that you do all work within this course (including written in class assignments, homework, and exams) with honesty and integrity. Academic Dishonesty includes (but not limited to) cheating on exams or quizzes and plagiarizing from sources such as textbooks, websites, or classmates work. I consider it academically dishonest to submit work plagiarized from any source including a solutions manual or exam/homework file.

**ACCOMMODATIONS FOR STUDENTS WITH DISABILITIES:** University of St. Thomas will make reasonable accommodations for students with documented disabilities. To arrange accommodation students should contact the **Counseling and Disability Services Office in Crooker Center.** This office can be reached at (713) 525-2169 or 6953. It is the student’s responsibility to discuss any necessary accommodations with the appropriate faculty member. Testing accommodations are provided at the Career Services and Testing Center as a convenience for faculty and students. The
Career Services and Testing Center is located at 3909 Graustark on the second floor of Crooker Center. The center works on an appointment basis. The student is responsible for making his/her own appointment by speaking with a Testing Center staff member.

**UPDATED COURSE INFORMATION:** Occasionally, I will send out an email or post an announcement on Blackboard. You are required to use your UST account to access such updated course information.

**DISCLAIMER:** I will adhere to the schedule and policies in this document as much as possible, but changes may be made during the semester. Announcements to this effect will be announced in lecture, by email or on your Blackboard account.

**COURSE ETIQUETTE:** Please be respectful of your classmates and your professor. Please do not carry on conversations with your neighbors during the lecture. If you are not respectful of the professor and your classmates, I will deduct points earned from your class participation points. To reiterate, the use of electronic devices for *personal business* is prohibited in class. If you have an emergency and need the use of your mobile devices for personal use, please step outside of the class to attend to it. If you are trying to inconspicuously text message or check email during class, you will be asked to leave class and will lose points from your class participation grade at my discretion.
# Tentative Laboratory Course Schedule

*Note:* This is a tentative schedule for laboratory experiments and may change as the semester progresses. There are no make-up labs. If you know that you will be missing a lab in advance, please notify me in writing (by email) in advance, so that we can make arrangements for you to complete the experiment during another laboratory period.

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<tr>
<th>WEEK</th>
<th>Experiments</th>
<th>Readings &amp; Due Dates</th>
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<tbody>
<tr>
<td>Aug 22</td>
<td>Syllabus and Check In</td>
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<td>Aug 29</td>
<td>Safety Quiz</td>
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<td></td>
<td><strong>01 Calibration of Volumetric Glassware:</strong> 25 mL pipet and 1000 µL micropipet</td>
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| Sept 5 | **01 Calibration of Volumetric Glassware:** 50 mL buret  
**02 Spectrophotometric Det. of Iron in Vitamin Tablets** | Chapters 1-4,  
01 Handout |
| Sept 12 | **02 Spectrophotometric Det. of Iron in Vitamin Tablets** (cont.) | 02 Handout,  
*01 Report due* |
| Sept 19 | **03 Spinach Pigment Analysis by Column Chromatography and UV-Vis Spectroscopy** | 03 Handout,  
*02 Report due* |
| Sept 26 | **04 HPLC Finalize Selection of Independent Projects** | 04 Handout,  
*03 Report Due*  
*06 Proposal Report due* |
| Oct 3  | **05 Potentiometric Titrations** | 04 Report due |
| Oct 10 | FALL BREAK | 05 Report due |
| Oct 17 | Group Project Experiments Begin | |
| Oct 24 | Group Project Experiments Continue | |
| Oct 31 | Group Project Experiments Continue | |
| Nov 7  | Group Project Experiments Continue | |
| Nov 14 | Group Project Experiments Conclude | |
| Nov 21 | THANKSGIVING BREAK | |
| Nov 28 | Group Presentations and Check Out |  
*Formal Project Reports (Individual) due 12/02* |