

GreenSheet Chem 5 L – Spring 2021

Instructor:	Dr. Griff Freeman
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Office Hours:	MW - 10:30 AM - 12:00 and by appointment. All office hours are virtual. Section 2 – Tuesday, Thursday - 10:30 AM– 1:20 PM
Class Days/Time:	Section 3 – Monday, Wednesday - 2:30 PM – 5:20 PM
Classroom:	Duncan Hall 413
Prerequisites:	You must have either previously passed or be currently registered for Chem 55 to take this course.

The first meeting for this course will be Thursday, January 28 at 10:30 AM. It will be online. You will be sent an invitation for a Zoom conference call. During the call I will discuss how the course will be run. If you have not received the invitation by January 26 please send me an email.

Because of the recent surge in COVID-19 cases we will not begin in-person classes until Feb 15. For the first two weeks of February you will have online work to do. You should be prepared to carry out that work at the times that the class is scheduled.

Because of uncertainties due to COVID-19 we will do our best to follow the plan for the semester that is laid out below. Please understand that we may need to change the plan at any time.

Although this section meets twice per week, each student will be in lab once per week and assigned out-of-lab work for the other day. For example, Mary White might be in lab on Monday from 2:30 until 5:20 and have online work on Wednesday from 2:30 until 5:20 while Maria Blanco would have online work on Monday from 2:30 until 5:20 and be in lab on Wednesday from 2:30 until 5:20. **All students must maintain the ability to carry out course work in person at both times during the week.**

During all in-person lab sessions, students will be required to wear a lab coat, lab goggles, and a facemask to prevent the spread of COVID-19.

Course Description

Chem 055L Quantitative Analysis Laboratory. Introduction to theories and techniques of chemical analysis. Lab 6 hours. 4 units.

The purposes of this laboratory course and Chem 55 are to prepare students for working in a chemical analysis laboratory. Students will learn how to make a variety of chemical measurements and how to properly interpret the resulting data. Topics covered include acid/base

and complexometric titrations, gravimetry, spectrophotometry, sample preparation, HPLC and voltammetry. Statistical concepts based on the normal distribution, such as confidence limits, t-tests, F-tests, and outlier testing will also be covered.

Course Format

Course materials such as syllabus, handouts, notes, assignment instructions, etc. can be found on Canvas Learning Management System course login website at <http://sjsu.instructure.com>. You are responsible for regularly checking with the messaging system through the [Spartan App Portal](http://one.sjsu.edu) <http://one.sjsu.edu> (or other communication system as indicated by the instructor) to learn of any updates.

Each student **must** have access to a computer and fast internet. The lab notebook will be online as will the lab manual. **A lab coat will be required for this course.** They can be found in the student bookstore and on Amazon.com. Information about purchasing an electronic lab notebook and manual will be distributed at the start of the semester.

Course Goals

Upon successful completion of this course, students will be able to:

PLO#3 – Demonstrate understanding of core concepts and to effectively solve problems in analytical chemistry.

PLO#6 – Answer questions regarding safe practices in the laboratory and general chemical safety.

PLO#7 – Demonstrate safe laboratory skills (including proper handling of materials and chemical waste) for particular laboratory experiments.

Course Learning Outcomes for Chemistry 55L

Upon successful completion of this course, students will be able to:

- CLO#1 – Perform accurate and precise analyses in the field of Analytical Chemistry
- CLO#2 – Keep records of all performed analyses in a manner which is required in a modern analytical laboratory.
- CLO#3 – Carry out statistical analysis and evaluate repeatability of obtained results.
- CLO#4 – Perform quantitative and qualitative analysis of known standards as well as unknown samples.
- CLO#5 – Identify, properly use, and care for equipment and supplies used in analytical laboratories.
- CLO#6 – Identify the requirements for the adequate protection of personnel from solvents and materials used in an analysis

Required Textbook

Quantitative Chemical Analysis; D.C.Harris, same edition as Chem 55 lecture.

Other Readings

Lab Manual: Chem 55L Quantitative Analysis Laboratory Manual: will be available online as part of LabArchives.

Other technology requirements / equipment / material

Lab Notebook: A laboratory notebook is required for all students. We will use an electronic lab notebook. Notebook pages will be due (by upload to the lab notebook web site) at the conclusion of each day of lab. Each page has to be electronically dated and signed.

You will be given an assignment through Canvas which will take you to the LabArchives website. You will not need to pay for LabArchives. When you sign up for LabArchives use your @sjsu.edu email address. This will prevent you from accidentally signing up more than once.

All primary data must be taken in the notebook and after each experiment summary and resume pages must be prepared in the lab notebook. In many industry or research laboratories or research laboratories, the lab notebook can be used as a legal document, so good notebook habits are essential for success in science. Notebooks can be purchase via a link which I will send to all enrolled students.

Course Requirements and Assignments

Success in this course is based on the expectation that students will spend, for each unit of credit, a minimum of 45 hours over the length of the course (normally three hours per unit per week) for laboratory instruction and work, completion of reports and studying for quizzes and exams.

Experiments: In Chem 55L we will:

1. Discuss quantitative chemical analysis, statistics and error analysis, chemical equilibria, acid-base and buffer chemistry, basic spectrophotometry, chromatography and electrophoresis.
2. Conduct lab experiments in acid-base and EDTA titrimetry, flame and solution photometry, electrochemistry, high performance liquid chromatography and capillary electrophoresis.

Final Examination or Evaluation

1. The final exam will be conducted on the date set by SJSU (see Academic Calendar)

- The final exam will cover the material from all the experiments performed in Chem 55L laboratory, including theory, practical information and calculations from each experiment.
- The final exam will be taken in class in DH 413 at the assigned time.

Chem 55L – Lab Activities (see schedule for dates)

- Check-in and preliminary operations
 - Safety orientation – safety quiz must be taken and passed before 2nd class.
- Reviewing Analytical Balances and Volumetric Glassware
- Gravimetric determination of calcium in a solid sample.
- Quiz - Gravimetry, Balances and Glassware
- Preparation of standard EDTA solution.
- EDTA determination of total hardness, calcium, and magnesium in brine sample.
- Manganese determination by atomic absorption spectrometry using both calibration curve and standard addition methods.
- Quiz - Complexometric Titrations, Spectrophotometry
- Preparation and standardization of 0.1 M NaOH.
- Calibration of pH electrode.
- Titration of a mixture of phosphoric acid and sodium dihydrogen phosphate.

13. Final Exam

Check out of your lab locker on or before the last day of laboratory. Students failing to check out officially will be charged a fee for the Service Center to check out the locker.

Chem 55 L Grading Information

- A 10-point penalty will be assigned for turning in reports after the due date.
- A 10-point penalty will be assigned for calculations that are wrong or report that is not in the correct format.
- It is possible to repeat a failed experiment; however, a new sample must be obtained from the instructor. A 10-point penalty will be assigned if the experiment has to be repeated.
- Each experiment will be graded for accuracy (difference between the value provided by manufacturer and value determined by student) and precision (determined by standard deviation of results).
- The Lab Notebook will be graded as follows: Daily reports dated and signed are due before midnight on the day of the lab. Daily report will be checked 3 random times for each student, each time is worth 50 points. Total 150 points. A missing or late lab report will result in a 10-point deduction. If pages are not signed there will be 5-point deduction.

Points per Assignment - Planned	
A0. Calibration	40

A1. Gravimetric	100
A2. Hard Water	115
A3. Mn UV	70
A4. Mn Atomic	70
B1. Phosphate	120
Lab Notebook Evaluation 1	30
Lab Notebook Evaluation 2	30
Quiz 1	75
Quiz 2	75
Quiz3 (final)	75
Online Work	200
Total	1000

Example of the grading scale for the Hardness experiment			
Key for Hardness		Key for Ca only	
Difference	Points	Difference %w/v	points
10 ppm	99	0.001	99
20 ppm	97	0.002	97
30 ppm	95	0.003	95
40 ppm	90	0.004	90
50 ppm	88	0.005	88
60 ppm	82	0.006	82

Course Grading Scale*,:**

A+ 97%-100%

A	93% - 96.99%
A-	90% - 92.99%
B+	87%-89.99%
B	83% - 86.99%
B-	80% - 82.99%
C+	77%-79.99%
C	73% - 76.99%
C_	70% - 72.99%

*Safety Quiz point are not included in the final grade.

** Based on the mean of the class performance the scale may be adjusted.

Course Schedule – may change

Week #	Date	Day's Activities
1	1/27, 1/28	Course overview, safety training, using LabArchives
2	2/1,2,3,4	A. Measurements of mass. B. Exercises on the use of LabArchives.
3	2/8,9,10,11	A. Gravimetric Methods and Gravimetric Calculations. Proper use of glassware B. Introduction to Excel.
4	2/15,16,17,18	A. Check-in; Glassware cleaning; Calibration of a Pipet. B. Gravimetry Problems
5	2/22,23,24,25	A. Finish Calibration of Pipet. Prepare for Gravimetric Determination of Ca^{2+} . B. Excel #2
6	3/1,2,3,4	A. Calibration of Pipet Report due. Finish Gravimetric Determination of Ca^{2+} . Prepare for Hard Water Titration. B. Preview of Hard Water experiment. EDTA Titration Calculations.

Week #	Date	Day's Activities
7	3/8,9,10,11	A. Finish Gravimetric Determination of Ca^{2+} . Begin Hard Water Titration. B. Advanced EDTA Titrations.
8	3/15,16,17,18	A. Quiz #1. Hard Water Titration. B. OPEN
9	3/22,23,24,25	A. Report on Gravimetric Determination of Ca^{2+} is due. Finish Hard Water Titration. Prepare for Manganese Determination in Steel. B. Plotting with Excel. Calibration Curves.
10	3/29,30,31, 4/1	Spring Break - No classes
11	4/5,6,7,8	A. Manganese determination in steel. B. More plotting with Excel
12	4/12,13,14,15	A. Quiz #2. Report on Hard Water due. Manganese determination in steel. B.OPEN
13	4/19,20,21,22	A. Titration of Mixture of Phosphates B. Derivative plots in Excel
14	4/26,27,28,29	A. Titration of Mixture. B. OPEN
15	5/3,4,5,6	. Titration of Mixture. B. TBD
16	5/10,11,12,13,	A. Finish Phosphate - Check out B. OPEN

Week #	Date	Day's Activities
Finals Week	5/18	Report Due: Phosphate
Final Exam		

Classroom Protocol

Penalties are imposed if an analysis must be repeated because of poor reported results or if results are reported after the announced deadlines. Adequate time is allotted to complete the assignments and to repeat some determinations. Because of COVID it is unlikely that students can make up missed work in another section. If the situation changes we can be more flexible. HOWEVER, A STUDENT SHOULD NEVER WORK ALONE, AND AN INSTRUCTOR SHOULD BE WITHIN SHOUTING DISTANCE. CELL PHONE CONVERSATIONS ARE NOT PERMITTED IN THE LAB. PLEASE EXIT TO THE HALLWAY IF YOU MUST MAKE OR RECEIVE A CALL.

University Policies

Per [University Policy S16-9](http://www.sjsu.edu/senate/docs/S16-9.pdf) (<http://www.sjsu.edu/senate/docs/S16-9.pdf>), relevant information to all courses, such as academic integrity, accommodations, dropping and adding, consent for recording of class, etc. is available on Office of Graduate and Undergraduate Programs' [Syllabus Information web page](http://www.sjsu.edu/gup/syllabusinfo/) at <http://www.sjsu.edu/gup/syllabusinfo/>". Make sure to visit this page, review and be familiar with these university policies and resources.

The following schedule is the best estimate of the instructor. It may be adjusted if the instructor feels the need to make changes.