

Green Sheet Chem 55 L – Fall 2021

Please consult the Canvas page for this course (<http://sjsu.instructure.com>) for all updates due to COVID which may occur at the beginning of the semester.

Instructor: Dr. Griff Freeman
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Office Hours: MW - 10:30 AM - 12:00 and by appointment.
Section 3 – Monday, Wednesday - 2:30 PM – 5:20 PM

Class Days/Time: Section 2 – Tuesday, Thursday - 10:30 AM– 1:20 PM

Classroom: Duncan Hall 413

Prerequisites: You must have either previously passed or be currently registered for Chem 55 to take this course.

For the start of the semester (and who knows for how long), SJSU is requiring all students and faculty to wear masks while indoors. This obviously includes this lab class. Please bring a mask to class and keep it in place during class.

The first meeting for this course will be either Wednesday, January 26 at 2:30 PM (Section 3) or Thursday, January 27 at 10:30 AM (Section 2). It will be held in Duncan Hall 413. Students will be in lab, in person twice a week for most of the semester. For the first meeting I will discuss how the course will be run and you will check in to your lab lockers.

We will do our best to follow the plan for the semester that is laid out below. However, because of uncertainties due to COVID-19 and the possibility of bad air quality days, please understand that we may need to change the plan at any time.

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

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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 \(Links to an external site.\)](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 1.1 - identify, formulate, and solve a range of chemistry problems (fundamental to complex) through application of mathematical, scientific, and chemical principles.

PLO 2.1. - develop an experiment to address a hypothesis using literature and execute the planned experiment using standard chemistry techniques.

PLO 2.2 - acquire, record, and critically evaluate data through use of instrumentation and software, appropriate record keeping practices, figure preparation, and scrutiny of experimental results.

PLO 2.3 - recognize and assess laboratory hazards, practice risk minimization, and conduct safe laboratory practices.

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.

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- 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. I strongly suggest that you bring either a laptop computer or tablet to lab in order to record your notes directly. If you cannot do this you are required to purchase a traditional lab notebook with carbon-copy pages (https://www.amazon.com/NATIONAL-Laboratory-Notebook-Brown-43649/dp/B000084QUG/ref=asc_df_B000084QUG/?tag=hyprod-20&linkCode=df0&hvadid=198081854790&hvpos=&hvnetw=g&hvrnd=12978273383608229018&hvpone=&hvptwo=&hvgmt=&hvdev=c&hvdvcmld=&hvlocint=&hvlocphy=9031921&hvtargid=pla-320573942356&psc=1 (Links to an external site.)). The copies must be handed in when you leave the lab.

You will be given an assignment through Canvas which will take you to the LabArchives website. The price for LabArchives is in the \$15-\$20 range. LabArchives provides both your electronic lab notebook and the Lab Manual for the course. All lab reports will also be submitted on 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.

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

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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)
2. 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.
3. The final exam will be taken in class in DH 413 at the assigned time.

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

You must 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.

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 \(Links to an external site.\)](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

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recording of class, etc. is available on Office of Graduate and Undergraduate Programs' [Syllabus Information web page \(Links to an external site.\)](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.

Grading Plan

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	100
A3. Mn UV	60
A4. Mn Atomic	60
B1. Phosphate	110
B2. Capsaicin	60

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Lab Notebook Evaluation 1	20
Lab Notebook Evaluation 2	30
Lab Notebook Evaluation 3	40
Quiz 1	70
Quiz 2	70
Quiz3 (final)	70
Prelabs/Excel Assignments/Etc.	170
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%

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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.

Schedule of Experiments

Course Schedule

Week #	Date	Day's Activities
1	1/26, 27	A. Course overview, safety training, using LabArchives. Check in
2	1/31, 2/1,2,3	A. Glassware cleaning; Measurements of mass; B. Experiment A0 - Calibration of a Pipet. C. Begin A1 - Gravimetric Determination of Ca D. Exercises on the use of LabArchives due
3	2/7, 8, 9, 10	A. Continue A1 - Gravimetric Determination of Ca B. Using Excel #1
4	2/14, 15, 16, 17	A. Finish A1 B. Lecture on EDTA Titrations C. Begin A2 - Determination of Hard Water by EDTA Titration D. Report for A0 due. E. Making Plots in Excel

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Week #	Date	Day's Activities
5	2/21, 22, 23, 24	A. Continue A2 - Determination of Hard Water by EDTA Titration
6	2/28, 3/1, 2, 3	A. Finish A2 - Determination of Hard Water by EDTA Titration B. Report for A1 due
7	3/7, 8, 9, 10	A. Begin A3 - Determination of Mn in steel B. Quiz on A0, A1 and statistics C. Method of Standard Addition
8	3/14, 15, 16, 17	A. Finish A3 - Determination of Mn in steel B. Submit 1 page report on A3 calculations
9	3/21, 22,, 23, 24	A. Begin B1 - Determination of mixture of phosphates B. Lecture - Excel for Calibration Curves. C. Report for A2 due
	3/28 – 4/1	Spring Break No class
10	4/4, 5, 6, 7	A. Continue B1 B. Begin A4
11	4/11, 12, 13, 14	A. Finish B1 B. Continue A4
12	4/18, 19, 20, 21	A. Finish A4 B. Begin B2 - HPLC determination of capsaicin C. Quiz 2 over A2, A3
13	4/25, 26, 27, 28	A. Continue B2 B. Report on B1 due

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Week #	Date	Day's Activities
14	5/2, 3, 4, 5	A. Continue B2 B. Report on A3/A4 due
15	5/9, 10, 11, 12	A. Finish B2 B. Last Day of instruction 5/12 for T-Th section – check out
16	5/16	Last Day of instruction for MW section Check out
Finals Week		Report Due: B2 - Determination of capsaicin