

San José State University
Chemistry Department
Chem 055L – Quantitative Analysis Lab, Sections 2 and 3, Fall 2019

Course and Contact Information

Instructor:	Dr. Griff Freeman
Office Location:	Duncan Hall 412B
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Email:	Richard.freeman@sjsu.edu
Office Hours:	Tuesday, Thursday 1:30 – 2:30
Class Days/Time:	Section 2 – Mon, Wed 2:30 – 5:20 Section 3 – Tues, Thurs 10:30 – 1:20
Classroom:	Duncan Hall 413
Prerequisites:	Listed in Catalog – Chem 055

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> (or other communication system as indicated by the instructor) to learn of any updates.

Each student should have access to a computer and fast internet. The lab notebook will be online as will the lab manual. Information about purchasing an electronic lab notebook and manual will be distributed at the start of the semester.

Course Description

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

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 analysis 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 Texts/Readings (Required)

Textbook

Quantitative Chemical Analysis; D.C.Harris, same edition as Chem 055 lecture

Other Readings

Lab Manual: Chem 55L Quantitative Analysis Laboratory Manual: will be available online

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.

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)
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 on Canvas in the computer classroom DH503.

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

1. Check-in and preliminary operations
 - a. Safety orientation – safety quiz must be taken and passed before 2nd meeting.
2. Review of an analytical balance.
3. Preparation of standard EDTA solution.
4. EDTA determination of total hardness, calcium, and magnesium in brine sample.

5. Manganese determination by atomic absorption spectrometry using both calibration curve and standard addition methods.
6. Complexing titrations, HPLC – Quiz
7. Gravimetric determination of calcium in a solid sample.
8. Gravimetric analysis – Quiz
9. Preparation and standardization of 0.1 M NaOH.
10. Calibration of pH electrode.
11. Titration of a mixture of phosphoric acid and sodium dihydrogen phosphate.
12. Submit explicit direction for the preparation of 500 mL of 0.050 M pH 7.0 phosphate buffer solution. Use activity coefficients.
13. Phosphates, HPCE – Quiz
14. HPLC (Determination of components of a mixture of polycyclic aromatic hydrocarbons by high performance liquid chromatography).
15. HPCE (Capillary Electrophoresis determination of analgesics) experiments are done in groups of 4 students (due to limited number of instruments).

Note: There will be a sign-up sheet for both experiments 14 and 15. The report for each experiment will be due after the following lab period. Grades for 14 and 15 will be based on individual reports, not a group report.

16. Determination of Ascorbic acid in a mixture by analytical voltammetry.
17. Calibration of an instrument (HPLC, AA, or Spec 20). Report any time before the end of the semester.
18. 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.

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.

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. If because of illness or other reasons a student falls behind she or he may work during the second lab section if permission is obtained in advance from the instructor. 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/>.

Course Schedule

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

Meeting # (Optional)	Date	Topics, Readings, Assignments, Deadlines (If appropriate, add any extra column(s) to meet your needs.)
1	8/21, 8/22	Check in, safety training, orientation
2	8/26, 8/27	EDTA Total hardness, Ca and Mg in brine sample

3	8/28, 8/29	EDTA Total hardness, Ca and Mg in brine sample. Manganese determination in steel sample.
4	9/3, 9/4	EDTA Total hardness, Ca and Mg in brine sample. Manganese determination in steel sample.
5	9/5, 9/9	EDTA Total hardness, Ca and Mg in brine sample. Manganese determination in steel sample.
6	9/10, 9/11	Report Due: Total Hardness & Calcium. Manganese determination in steel sample. Group Experiment (HPLC)
7	9/12, 9/16	Manganese determination in steel sample. Group Experiment (HPLC)
8	9/17, 9/18	Manganese determination in steel sample. Group Experiment (HPLC)
9	9/19, 9/23	Manganese determination in steel sample. Group Experiment (HPLC)
10	9/24, 9/25	Manganese determination in steel sample. Group Experiment (HPLC)
11	9/26, 9/30	Quiz #1. After the quiz Manganese determination in steel.
12	10/1, 10/2	Manganese determination in steel. Gravimetric determination of calcium in a solid sample.
13	10/3, 10/7	Manganese determination in steel. Gravimetric determination of calcium in a solid sample.
14	10/8, 10/9	Report Due: Manganese determination (180 points). Gravimetric determination of calcium in a solid sample.
15	10/10, 10/14	Gravimetric determination of calcium in a solid sample.
16	10/15, 10/16	Gravimetric determination of calcium in a solid sample. Group Experiment: HPCE.
17	10/17, 10/21	Gravimetric determination of calcium in a solid sample. Group Experiment (two groups): HPCE.
18	10/22, 10/23	Quiz 2: Gravimetric determination of calcium in a solid sample. Group Experiment (two groups): HPCE.
19	10/24, 10/28	Gravimetric determination of calcium in a solid sample. Phosphates titration.
20	10/29, 10/30	Report Due: Gravimetric report (100 points). Phosphates titration.
21	10/31, 11/4	Phosphates Titration
22	11/5, 11/6	Phosphates titration: Group experiment HPCE.
23	11/7, 11/11	Phosphates titration: Group experiment HPCE.
24	11/12, 11/13	Phosphates titration. Group experiment HPCE.
25	11/14, 11/18	Report due: Phosphates (200 points), pH electrode (20 points), buffer preparation (20 points).
26	11/19, 11/20	Quiz 3. Vitamin C determination. Calibration of an instrument.
27	11/21/11/25	Vitamin C determination. Calibration of an instrument.
28	11/26, 12/2	Vitamin C determination. Calibration of an instrument.

29	12/3, 12/4	Finish all Lab Work
30	12/5, 12/9	Check out of Lab – Final due date for Vitamin C and Calibration Report. Final due date for lab notebook
Final Exam		Section 2 – Tuesday December 17 – 12:15 PM – 2:30 PM Section 3 - Friday December 13 – 9:45 AM – 12:00 PM