Chemistry 3005 - Quantitative Analysis Laboratory
Fall 2021

Course Name: Quantitative Analysis Laboratory

Time/Location: M 2:30-5:20 or Th 12:30-3:20 p.m. ML 144

Instructor: Robert Brown Office W026 Phone: 797-0545, email: bob.brown@usu.edu

Teaching Assistants: Jesse Brown (jesse.brown@usu.edu)

Dr. Brown's Office Hours: T 3:00-4:00 PM, W 2:30-3:30 PM and by appointment (all conducted via Zoom Video Conferencing). Note: these office hours are subject to change.

Teaching Assistant office hours will be announced at the first laboratory meeting.

Fall 2021 COVID-19 Laboratory Protocols

In order to continue to provide various forms of face-to-face instruction at USU, and to limit the spread of COVID-19 during the pandemic, students are asked to follow certain classroom protocols during the fall 2021 semester. These protocols are based on CDC, state, and local health department guidelines and requirements are in place not only for your safety but also the safety of the entire campus community.

- **Face coverings are requested in all classrooms and teaching laboratories. Please observe social distancing and consider getting a free Covid vaccination. Students wearing a mask will help keep the lab meeting face-to-face.**
- **Follow faculty instructions regarding social distancing and entering/exiting classrooms.**
- **Stay home when you are sick, however mild your symptoms. Get a free university sponsored Covid test and report any positive results to the Covid care team.**

Text*: USU Department of Chemistry and Biochemistry Chemistry 3005 Laboratory Manual.* A copy will be provided to each student and an electronic version will be available on Canvas.

Required Materials: A bound laboratory notebook (will be discussed at first lab meeting); safety goggles; a laboratory coat; writing implement and scientific calculator.

Course Content: This course consists of seven laboratory experiments. Laboratories include experiments in volumetric, gravimetric, and instrumental methods of chemical analysis. Instrumental methods include: electrochemistry, gas chromatographic separations and emission and absorption spectrophotometry.

Course Grading: Course performance will be evaluated based on the accuracy of reported experimental results, two laboratory notebook checks (scored based upon proper data entry, individual laboratory housekeeping, general quality of notebook entries and answers to pre and post lab questions associated with the various experiments) and an in-class final quiz.

Grading Points Breakdown: Each experiment has a maximum score of 100 points. Laboratory notebook checks will count 50 points each. The final quiz is 100 points**.**

Maximum Points	Task
700	7 Experiments
100	Laboratory notebook checks
100	Final quiz
900	**Total Points**

The maximum letter grade ranges will be: A, 90-100%; B, 80-89%; C, 70-79%; D, 60-69%; F, below 60%. These ranges may be adjusted lower but will not be raised higher. Grade modifiers of plus (+) and minus (-) will also be used for final laboratory letter grades. See lab manual for more details on grading and lab result due dates.

Withdrawal Policy: This course will follow the University policy on withdrawals stated in the current Undergraduate Catalog. Drop dates are listed in the Schedule of Classes. You must check out of the laboratory (as outlined in the laboratory manual) if you drop the class. You must clean your glassware and return your lab drawer key. **Note: failure to do so will result in a hold on your academic records until this is completed. Failure to return your lab drawer key will result in a fine (cost of replacing the drawer lock) that will need to be paid before the hold on your records will be released.**

Missed Laboratory Policy: Due to the number of laboratories and their associated scheduling, there will generally be limited opportunity for students to makeup laboratories. Students are required to attend all laboratories as scheduled (see laboratory manual). **Due to space limitations and safety concerns, students may only attend the laboratory section for which they are registered unless prior approval is obtained from the Instructor**. A missed laboratory due to a documented illness, family emergency or a university approved absence will be dealt with as to final course grade by the instructor on a case-by-case basis.

Lab results are due at the beginning (**first 5 minutes**) of the next regularly scheduled lab period (not including weeks when no lab is held for a particular group). Late submission of laboratory results will be penalized 5 points for the first late day and up to 10 total points per week that the results are late. No repetition of experiments is permitted.

Attendance Policy: Laboratory attendance is mandatory for successful performance in this course. Laboratory attendance is monitored each week and failure to attend without an acceptable excuse will result in a grade of zero for that laboratory.

Student Disability Statement: Any student with a disability that requires accommodations must contact the Instructor. The disability must be documented by the Disability Resource Center. Course materials may be requested in alternative formats.

Service Animals in Chemistry Labs Statement: Utah State University is committed to providing access for service dog handlers. Due to the unique nature of the laboratory environment, service animal handlers must meet with the Disability Resource Center prior to bringing a service dog into the lab. The purpose of this meeting is not to prevent you from having your service animal with you but rather to understand how to best accommodate your needs and the needs of your animal. Please contact the Disability Resource Center at 435-797-2444 or drc@usu.edu to set up an appointment. Students will be required to provide approved PPE for any service animal.

Laboratory Fee Statement: A laboratory fee ($75) is required for this course. The laboratory fee is used to pay for reagents, help maintain the instrumentation and replace broken glassware and covers a small portion of the lab Teaching Assistant's support.

Assessment Statement: The value of a quantitative chemical analysis laboratory is to develop the necessary laboratory skills to be able to perform accurate and reliable experimentation in a variety of scientific fields. Laboratory learning objectives are evaluated by comparing student results of analyzed unknowns to those reported in previous years.

Learning Objectives:

- Comprehend the importance of stoichiometry, chemical equilibrium and kinetics in analysis
- Understand laboratory and chemical safety
- Formulate concepts of validation of data and experimental design

- Comprehend concept of and perform chemical measurement calibration
- Apply and assess concepts of availability and evaluation of analytical standards and formulate standardization methodology
- Demonstrate knowledge of sampling methods for all states of matter
- Use statistical methods for evaluating and interpreting data
- Assess sources of error in chemical analysis and account for errors in data analysis
- Recognize interferences in chemical and instrumental analysis
- Apply theory and operational principles of analytical instruments
- Demonstrate practical aspects of theoretical principles discussed in the Chem 3000 course

Experiment grading rubric: percent relative error vs. numerical grade

Score	% relative error		Score	% relative error
100	0.00		73	5.80
99	0.10		72	6.20
98	0.20		71	6.60
97	0.30	**cutoff for regrading**	**70**	**7.00**
96	0.40		69	7.50
95	0.50		68	8.00
94	0.60		67	8.50
93	0.70		66	9.00
92	0.80		65	9.50
91	0.90		64	10.00
90	1.00		63	10.50
89	1.20		62	11.00
88	1.40		61	11.50
87	1.60		60	12.00
86	1.80		59	12.60
85	2.00		58	13.20
84	2.20		57	13.80
83	2.40		56	14.40
82	2.60		55	15.00
81	2.80		54	15.60
80	3.00		53	16.20
79	3.40		52	16.80
78	3.80		51	17.40
77	4.20		50	18 and above
76	4.60			
75	5.00			
74	5.40			

Chemistry 3005 Laboratory Schedule (Fall 2021)

Monday Section	Thursday Section	Monday Section	Thursday Section
Aug. 30 No Labs	Sept. 2 No Labs	Sept. 6 No Labs Labor Day	Sept. 9 Lab Check-In, Lab Safety Review, Cleaning Glassware, Basic lab skills
Sept. 13 Lab Check-In, Lab Safety Review, Cleaning Glassware, Basic lab skills	Sept. 16 Experiment 1: Water Hardness titrations	Sept. 20 Experiment 1: Water Hardness titrations	Sept. 23 Week 1 of Rotating Labs Experiments 2-7
Sept. 27 Week 1 of Rotating Labs Experiments 2-7	Sep. 30 Week 2 of Rotating Labs Experiments 2-7	Oct. 4 Week 2 of Rotating Labs Experiments 2-7	Oct. 7 Week 3 of Rotating Labs Experiments 2-7
Oct. 11 Week 3 of Rotating Labs Experiments 2-7	Oct. 14 Week 4 of Rotating Labs Experiments 2-7	Oct. 18 Week 4 of Rotating Labs Experiments 2-7	Oct. 21 Week 5 of Rotating Labs Experiments 2-7
Oct. 25 Week 5 of Rotating Labs Experiments 2-7	Oct. 28 Week 6 of Rotating Labs Experiments 2-7	Nov. 1 Week 6 of Rotating Labs Experiments 2-7	Nov. 4 Week 7 of Rotating Labs Experiments 2-7
Nov. 8 Week 7 of Rotating Labs Experiments 2-7	Nov. 11 Week 8 of Rotating Labs Experiments 2-7	Nov. 15 Week 8 of Rotating Labs Experiments 2-7	Nov. 18 Lab Final Quiz and Checkout Section 002 End of Labs
Nov. 22 Lab Final Quiz and Checkout Section 001 End of Labs	Nov. 25 Thanksgiving Break - No Labs	Nov. 29 No Labs	Dec. 2 No Labs
Dec. 6 No Labs	Dec. 10 No Labs		

Chemistry 3005 Laboratory 7 Group Schedule for Rotating Labs (Fall 2021)

Monday Section	Thursday Section	Monday Section	Thursday Section
Exp. 2 Determination of Iron Exp. 3 Flame Photometry Exp. 4 Titration of acid mix Exp. 5 Electrogravimetric Cu Exp. 6 Gas Chromatography Exp. 7 Spectrophotometry	Sept. 23 Group 1 No Lab Group 2 Determination of Iron Group 3 Flame Photometry Group 4 Titration of acid mix Group 5 No Lab Group 6 Electrogravimetric Cu Group 7 Gas Chromatography	Sept. 27 Group 1 No Lab Group 2 Determination of Iron Group 3 Flame Photometry Group 4 Titration of acid mix Group 5 No Lab Group 6 Electrogravimetric Cu Group 7 Gas Chromatography	Sept. 30 Group 1 Spectrophotometry Group 2 No Lab Group 3 Determination of Iron Group 4 Flame Photometry Group 5 Titration of acid mix Group 6 No Lab Group 7 Electrogravimetric Cu
Oct. 4 Group 1 Spectrophotometry Group 2 No Lab Group 3 Determination of Iron Group 4 Flame Photometry Group 5 Titration of acid mix Group 6 No Lab Group 7 Electrogravimetric Cu	Oct. 7 Group 1 Gas Chromatography Group 2 Spectrophotometry Group 3 No Lab Group 4 Determination of Iron Group 5 Flame Photometry Group 6 Titration of acid mix Group 7 No Lab	Oct. 11 Group 1 Gas Chromatography Group 2 Spectrophotometry Group 3 No Lab Group 4 Determination of Iron Group 5 Flame Photometry Group 6 Titration of acid mix Group 7 No Lab	Oct. 14 Group 1 Electrogravimetric Cu Group 2 Gas Chromatography Group 3 Spectrophotometry Group 4 No Lab Group 5 Determination of Iron Group 6 Flame Photometry Group 7 Titration of acid mix
Oct. 18 Group 1 Electrogravimetric Cu Group 2 Gas Chromatography Group 3 Spectrophotometry Group 4 No Lab Group 5 Determination of Iron Group 6 Flame Photometry Group 7 Titration of acid mix	Oct. 21 Group 1 No Lab Group 2 Electrogravimetric Cu Group 3 Gas Chromatography Group 4 Spectrophotometry Group 5 No Lab Group 6 Determination of Iron Group 7 Flame Photometry	Oct. 25 Group 1 No Lab Group 2 Electrogravimetric Cu Group 3 Gas Chromatography Group 4 Spectrophotometry Group 5 No Lab Group 6 Determination of Iron Group 7 Flame Photometry	Oct. 28 Group 1 Titration of acid mix Group 2 No Lab Group 3 Electrogravimetric Cu Group 4 Gas Chromatography Group 5 Spectrophotometry Group 6 No Lab Group 7 Determination of Iron
Nov. 1 Group 1 Titration of acid mix Group 2 No Lab Group 3 Electrogravimetric Cu Group 4 Gas Chromatography Group 5 Spectrophotometry Group 6 No Lab Group 7 Determination of Iron	Nov. 4 Group 1 Flame Photometry Group 2 Titration of acid mix Group 3 No Lab Group 4 Electrogravimetric Cu Group 5 Gas Chromatography Group 6 Spectrophotometry Group 7 No Lab	Nov. 8 Group 1 Flame Photometry Group 2 Titration of acid mix Group 3 No Lab Group 4 Electrogravimetric Cu Group 5 Gas Chromatography Group 6 Spectrophotometry Group 7 No Lab	Nov. 11 Group 1 Determination of Iron Group 2 Flame Photometry Group 3 Titration of acid mix Group 4 No Lab Group 5 Electrogravimetric Cu Group 6 Gas Chromatography Group 7 Spectrophotometry
Nov. 15 Group 1 Determination of Iron Group 2 Flame Photometry Group 3 Titration of acid mix Group 4 No Lab Group 5 Electrogravimetric Cu Group 6 Gas Chromatography Group 7 Spectrophotometry	Nov. 18 No Scheduled Labs Lab Final Quiz and Checkout Section 002 End of Labs	Nov. 22 Lab Final Quiz and Checkout Section 001 End of Labs	