



## Chemistry 214, Quantitative Analysis Lab Fall 2024 Syllabus

### Chem 214-001, Quantitative Analysis Lab (1 credit hour) August 26 – December 6, 2024

**Prerequisite:** Chem 106/102 and Chem 212

**Lab Location:** Flanner Hall 313. Section (001) 1:40-5:40pm Fridays

**Instructors:**

Teaching Assistant (TA): Emily Dominique, [edominique@luc.edu](mailto:edominique@luc.edu)  
Office Hour: FH-204 Tuesday 11:00 AM.

Laboratory Coordinator: Dr. Conrad Naleway  
Office Hours in FH-200C 12:00-1:30 PM immediately prior to lab on Fridays and Zoom appointment (schedule in advance). <https://luc.zoom.us/j/4950829636>  
Email: [cnalewa@luc.edu](mailto:cnalewa@luc.edu) | Phone: (773) 508-3115  
Office: Flanner Hall 200C

**Course Meeting Times:** Students are only allowed to attend the course section they are formally enrolled in according to LOCUS. This course has mostly synchronous (real-time, in-person lab experiments) work and one virtual online assignment on HPLC. It is the student's responsibility to pay attention to all course information, including the course schedule at the end of this syllabus. As a student enrolled in the course, you agree to abide by the syllabus and complete all course aspects including rules, requirements, labs/experiments/activities, lab report, assignments, homework, quizzes, abiding by due dates, etc. This course requires your full commitment. All times listed are Central Standard Time (CST). Expect the experiments to take the full 4-hours to complete!

**On all scheduled lab days, students must come to lab to complete in person lab experiments/lab activities. Students are assigned days to come to lab and can only come to the lab section that they are formally enrolled in in LOCUS. Students cannot go to the other lab sections. No exceptions.**

**Course Description:** This lab course emphasizes application of topics/theory covered in the lecture course (Chem 212). It reminds students of laboratory and chemical safety, introduces students to classical and modern methods of chemical analysis wet chemical laboratory techniques in an online environment, demonstrates use of Excel for basic statistics and experimental data analysis, and exposes students to real-world experimental data to be prepared for future use of lab techniques and instrumentation. Topics covered will include Microsoft Excel, basic statistics and data analysis, acid-base titration, pH titration curves and corresponding derivative graphs, a module on chromatography focused on High-Performance Liquid Chromatography (HPLC), Ion Chromatography (IC), and Gas Chromatography (GC), and a UV-Vis spectrophotometry module with a focus on external standards use and standard addition use to answer chemical questions about two analytes. Students will also be introduced on how to evaluate an analyte using ATR-FTIR spectroscopy. Chemical knowledge spanning from general chemistry to new topics in Chem 212 lecture is vital. This list is not exhaustive but mentions the highlights. To be successful in any course [including this one], an honest effort and time commitment on the students' part is vital. Students must choose to commit to learning course material, adequately manage time, complete course work, and ask for assistance when things are unclear.

## Course Goals & Outcomes for Students:

### Goals:

- Teach the basics of Microsoft Excel and capabilities for data organization, graphing, data analysis, and statistics to note the importance of accuracy & precision of laboratory work
- Acquaint students with common classical and modern techniques in analytical chemistry
- Expose students to classical conventional data collection and instrumental data similar to what is gathered in both commercial and academic laboratories
- Convey importance of interpretation and evaluation of experimental results, as well as being able to effectively report experimental results through scientific writing

### Outcomes:

- Apply knowledge of Microsoft Excel capabilities to organize and analyze data through basic statistics; generate experimental graphs that are up to the standard of scientific publications
- Evaluate accuracy, precision, and validity of experimental data through applied techniques learned in MS Excel
- Demonstrate proficiency in the set-up of lab equipment and completion of experiments using classical and instrument techniques and understanding how changing instrument conditions affects analyte analysis
- Articulate experimental results in the format of scientific writing through lab reports

### Required Materials:

1. Long-sleeve lab coat [white preferred, but any color is fine]. You must purchase this [LUC Bookstore or Amazon]. This is required in the laboratory at all times.
2. Lab goggles. Lab Coordinator will provide 1 free pair of goggles. Goggles required in the laboratory at all times.
3. Dressing appropriately for laboratory work, use of chemicals and glassware. See Footwear/Clothing section.
4. Composition style notebook (not spiral bound & no tear-out perforations). Line ruled. You must purchase this.
5. Chem 214 Lab Manual. Provided for free as a PDF in Sakai. Lab Coordinator will print 1 copy per student.
6. Cell Phone Pic to PDF app (such as CamScanner), for iPhone or Android. Any app that will convert a phone picture to a PDF file
7. A non-erasable pen. Pencil and white out are not allowed.
8. Scientific OR graphing calculator. Suggested model: CALC TI30XA SCIENTIF/STAT FRAC. A graphing calculator is o.k. too. Cell phones are not calculators; do not use them for calculations.
9. [Sakai access](#) (free for LUC students) via the internet to review and complete course content, access resources, review grades, etc.
10. Desktop or Laptop computer. Instrument simulation webpages may not work on tablets nor mobile devices and Sakai does not display well on them.
11. [ZOOM video & web conferencing software](#) (free for LUC students).
12. Panopto (free for LUC students). One format of recorded course content is Panopto videos. You may be prompted to log in with UVID username and password to view the specific videos. Links to videos will be provided in Sakai or via email when necessary.

### Mask Requirement:

Masks are optional but HIGHLY encouraged. Consider the absence policy and the fact there are very limited opportunities to make up an in-person lab experiment. Masks mitigate illness/spread of it. It is course policy that if during the semester the University re-institutes/reverts back to required mask wearing, we will do so immediately.

### Footwear/Clothing:

Closed toe, closed heel shoes are required [no sandals, flip flops, slippers, Crocs, ballet flats, boat shoes, perforated shoes, etc.] No skin on legs, ankles, or feet can be exposed. Long pants recommended. Shorts and skirts [unless floor length] are not allowed. Bare skin on the lower extremities is a safety hazard: Be advised,

concentrated acids/bases will be used in some lab experiments. Lab coats, goggles, mask, and gloves are required and must be worn at all times. This even applies when cleaning glassware! Lab coats must be fully buttoned to be an effective shield against chemicals. Students will be sent home if proper clothing or footwear is not worn, this counts as an absence. A safety lecture will be given the 1<sup>st</sup> week of class; this lecture is required to perform lab experiments. Students will sign a lab safety sheet acknowledging their understanding and commitment to adherence of lab safety rules/policies. If a student is absent the 1<sup>st</sup> day and misses the safety lecture, they cannot perform wet chemistry until the safety lecture is completed & safety sheet is signed. It is advised students do not wear contact lenses in the laboratory, as contact lens material may react with chemicals/ chemical vapors if they get into the eye. All rules are meant to keep students safe in the laboratory. Lab Coordinator and TA have complete discretion to prohibit a student from completing lab work if the student has clothing/footwear exhibiting a potential safety hazard OR exhibits behavior deemed unsafe to self or students.

### **Instructional Format:**

- Majority of the course is synchronous but there are a few asynchronous lab sessions. The class will be split in half into Group A and Group B; while some students [Group A] are synchronously in person completing lab experiments other students [Group B] will be completing online lab activities or in person completing a completely different lab. Then the next week they'll switch. Pedagogically, this enhances the laboratory experience as students will work independently, relying on their own lab skills to collect data and earn grades based on the accuracy of that data. There will be no partner labs as a result. This course design ensures students learn the skills first-hand in the laboratory and in the online lab activities, essential for real-world experience. Speaking from experience, when working in industry and in graduate school scientists analyze 100's of samples per day and could only rely on her lab skills learned.
- Attendance in synchronous sessions in person in the laboratory is required. I understand that "life happens" so if you must be absent contact Dr. Naleway right away. Allowances may be made to let a student come to the laboratory during their "off" [asynchronous] week but this will be decided on a case by case basis. Due dates for course work are not adjusted for absences. All assigned items have specific due dates.
- Other than office hours or a scheduled appointment, the laboratory sessions are the only other "real-time" opportunity to ask questions and communicate. Emails work great, but they are not "real-time." There is a delay with an email reply. Keep that in mind.

### **General Policies:**

- Course work will be graded with an emphasis on correct significant digits, consistent results (do data & observations match conclusions), correctness of calculations, data analysis, or optimal instrument conditions for analyte applications, appropriate use of Excel functions, and thoroughness in responses. Following directions of reporting calculated answers are taken into account too.
- The Composition notebook needs to contain all laboratory experiment information [Date, Title, data/observations/calculations, and conclusion for an experiment]. Use the notebook as a resource. Feel free to take class notes in it to organize your thoughts too. Notebooks will be signed at beginning and end of lecture.
- Before coming into the lab you need enter into your notebook the Date, Title of Experiment and most importantly the laboratory procedure IN YOUR OWN WORDS. This will help you pre-organize your thoughts and minimize waited time in starting experiments.
- There is a point value associated with the work, and one cannot earn points for work not completed. Students are expected to complete all course work; no makeup work is given. Not completing work for 2 or more of the in-person lab experiments or online activities is significant and unacceptable and will result in academic failure.
- If a student was previously enrolled in a Chem 214 course but didn't finish it [dropped/withdraw] or didn't pass, note that any data collected for experiments in a previous Chem 214 course or course assignments are NOT valid in this semester. Students must complete all experiments & coursework in this current semester of course.

**Pass/Fail Conversion Deadlines and Audit Policy:** A student may request to convert a course into or out of the “Pass/No-Pass” or “Audit” status only within the first two weeks of the semester. For the Fall 2024 semester, students are able to convert a class to “Pass/No-Pass” or “Audit” through Monday, September 9th. Students must submit a request for Pass/No-Pass or Audit to their Academic Advisor.

**Course Repeat Rule:** Effective with the Fall 2017 semester, students are allowed only THREE attempts to pass Chemistry courses with a C- or better grade. The three attempts include withdrawals (W). The Department advises that it is preferable to complete a course with a grade of C or C-, and to demonstrate growth in future coursework, than to withdraw from a course. After the second attempt, the student must secure Department approval for a third attempt. Students must fill out the [Permission to Register Form](#), and arrange a meeting with the Undergraduate Program Director, Assistant Chairperson, or Chairperson in Chemistry. If approved, a signed copy of this form is then sent to the student's Advising office to secure final permission for the attempt.

**Previous Course Work When Repeating the Course:** If you were enrolled in a Chem 214 lab course in a previous semester and are re-taking it for any reason [withdraw, drop, unfavorable grade, etc.], please note that any coursework, data, etc. from a previous semester does NOT count in the current semester the course is being taken. Students must complete all coursework within the same semester of the enrolled course. Any previous data or coursework taken in prior semesters does not count in the current semester.

**Health, Safety, and Well-Being On-Campus:** Please be familiar with and adhere to all policies and protocols posted on the Campus Info & Resources site: <https://www.luc.edu/healthsafetyandwellbeing/campusinforesources>

**Copyright/Intellectual Property reminder:** Course materials provided by your instructors at Loyola, including my materials, may not be shared outside any course without the instructor's written permission. Content posted without permission will be in violation of Copyright/Intellectual Property laws. Class meetings may not be recorded without the instructor's written permission.

(e.g., <https://www.luc.edu/ool/onlinelearningguidelines/guidelinesforrecordingstudentsduringonlineclasses/>)

**Recording of online class meetings:** In this class software will be used to record live class discussions. As a student in this class, your participation in live class discussions will be recorded. These recordings will be made available only to students enrolled in the class, to assist those who cannot attend the live session or to serve as a resource for those who would like to review content that was presented. All recordings will become unavailable to students in the class when the Sakai course is unpublished (i.e. shortly after the course ends, per the [Sakai administrative schedule](#)). Students who prefer to participate via audio only will be allowed to disable their video camera so only audio will be captured. Please discuss this option with your instructor. The use of all video recordings will be in keeping with the University Privacy Statement shown below

**Privacy Statement:** Assuring privacy among faculty and students engaged in online and face-to-face instructional activities helps promote open and robust conversations and mitigates concerns that comments made within the context of the class will be shared beyond the classroom. As such, recordings of instructional activities occurring in online or face-to-face classes may be used solely for internal class purposes by the faculty member and students registered for the course, and only during the period in which the course is offered. Students will be informed of such recordings by a statement in the syllabus for the course in which they will be recorded. Instructors who wish to make subsequent use of recordings that include student activity may do so only with informed written consent of the students involved or if all student activity is removed from the recording. Recordings including student activity that have been initiated by the instructor may be retained by the instructor only for individual use.

**Disabilities Accommodations:** If you have a documented disability and wish to discuss academic accommodations, please see your instructor by the second meeting of lab. (The Coordinator of Services for

Students with Disabilities is located in the Sullivan Center for Student Services, Suite 260, 508-7714 and must be contacted independently.)

**Appropriate in Class Behavior and use of Electronic Devices:** Rude, disruptive behavior (such as viewing computer materials not concerning class subjects, texting or talking on phones...) will not be tolerated. Voice recording but not visual recording is allowed for pre-lab lectures. Cell phones, pagers, wireless PDAs, etc. must be turned off during lab. If your device is activated during lab, you must leave the lab immediately and cannot return for the duration of that lab period.

#### **NOTICE OF REPORTING OBLIGATIONS FOR RESPONSIBLE CAMPUS PARTNERS:**

As an instructor, I am a Responsible Campus Partner ("RCP") under Loyola's Comprehensive Policy and Procedures for Addressing Discrimination, Sexual Misconduct, and Retaliation (available at [www.luc.edu/equity](http://www.luc.edu/equity)). While my goal is for you to be able to engage fully and authentically with our course material through class discussions and written work, I also want to be transparent that as a RCP I am required to report certain disclosures of sexual misconduct (including sexual assault, sexual harassment, intimate partner and/or domestic violence, and/or stalking) to the Office for Equity & Compliance ("OEC"). As the University's Title IX office, the OEC coordinates the University's response to reports and complaints of sexual misconduct (as well as discrimination of any kind) to ensure students' rights are protected.

As an instructor, I also have an obligation under Illinois law to report disclosures of or suspected instances of child abuse or neglect. <https://www.luc.edu/hr/legal-notices/mandatedreportingofchildabuseandneglect/>

The University maintains such reporting requirements to ensure that any student who experiences sexual/gender-based violence receives accurate information about available resources and support. Such reports will not generate a report to law enforcement (no student will ever be forced to file a report with the police). Additionally, the University's resources and supports are available to all students even if a student chooses that they do not want any other action taken. If you have any questions about this policy, you are encouraged to contact the OEC at [equity@luc.edu](mailto:equity@luc.edu) or 773-508-7766.

If you ever wish to speak with a confidential resource regarding gender-based violence, I encourage you to call The Line at 773-494-3810. The Line is staffed by confidential advocates from 8:30am-5pm M-F and 24 hours on the weekend when school is in session. Advocates can provide support, talk through your options (medical, legal, LUC reporting, safety planning, etc.), and connect you with resources as needed -- without generating a report or record with the OEC. More information about The Line can be found at [luc.edu/wellness](http://luc.edu/wellness).

#### **USE OF APPROPRIATE NAMES AND PRONOUNS:**

Addressing one another at all times by using one's chosen modes of address (including preferred names and gender pronouns) honors and affirms individuals of all gender identities and gender expressions. Misgendering and heteronormative language excludes the experiences of individuals whose identities may not fit within a gender binary, and/or who may not identify with the sex they were assigned at birth.

If you wish, please share your gender pronouns with me and the class when you introduce yourself, on your name placard, and/or on your Zoom profile. If you do not wish to be called by the name that appears on the class roster or attendance sheet, please let me know privately and I will work diligently to honor your wishes. My goal is to create an affirming environment for all students so that everyone can learn and engage as our full and true selves.

#### **Information about Accessibility Support and Student Support: Requests for Accommodation**

Loyola University Chicago provides reasonable accommodations for students with disabilities. Any student requesting accommodations related to a disability or other condition is required to register with the Student Accessibility Center (SAC). Professors will receive an accommodation notification from SAC, preferably within the first two weeks of class. Students are encouraged to meet with their professor individually in order to

discuss their accommodations. All information will remain confidential. Please note that in this class, software may be used to audio record class lectures in order to provide equal access to students with disabilities. Students approved for this accommodation use recordings for their personal study only and recordings may not be shared with other people or used in any way against the faculty member, other lecturers, or students whose classroom comments are recorded as part of the class activity. Recordings are deleted at the end of the semester. For more information about registering with SAC or questions about accommodations, please contact [SAC](#) at 773-508-3700 or [SAC@luc.edu](mailto:SAC@luc.edu). If you use the Testing Center, please schedule all of the tests for this class at the beginning of the semester. If a scheduled test date changes, you will still be accommodated if you had scheduled your test in advance. If you have any questions or concerns regarding the implementation of your accommodations in this course, please contact the SAC for assistance.

### **Attendance:**

**Additional Dates:** Please be aware of the University Schedules which include drop dates and holidays: [www.luc.edu/academics/schedules](http://www.luc.edu/academics/schedules)

**Accommodations for Religious Observances:** If you have observances of religious holidays that will cause you to miss class or otherwise effect your academic work in the course, you must alert the instructor no later than Friday of Week 2 in the semester to request accommodations. Advance notice must be sent to the instructor through Loyola email by this deadline.

**Loyola University Absence Policy for Students in Co-Curricular Activities (including ROTC):** Students missing classes while representing Loyola University Chicago in an official capacity (e.g., intercollegiate athletics, debate team, model government organization) shall be allowed by the faculty member of record to make up any assignments and to receive notes or other written information distributed in the missed classes. Students should discuss with faculty the potential consequences of missing lectures and the ways in which they can be remedied. Students must provide their instructors with proper documentation i.e., "[Athletic Competition & Travel Letter](#)" describing the reason for and date of the absence. This documentation must be signed by an appropriate faculty or staff member, and it must be provided to the professor in the first week of a semester. It is the responsibility of the student to make up any assignments. If the student misses an examination, the instructor is required to allow the student to take the examination at another time. (<https://www.luc.edu/athleteadvising/attendance.shtml>). Students who will miss class for an academic competition or conference must provide proper documentation to their instructor as early in the semester as possible. Advance notice must be sent to the instructor through Loyola email.

**Accommodations via Student Accessibility Center (SAC) Policy:** If you have a documented disability and wish to discuss academic accommodations, discuss with the Lab Coordinator as soon as possible, ideally the first week of the semester. The Coordinator of Student Accessibility Center (SAC), formerly referred to as SSWD, is located in the Sullivan Center and must be contacted independently by you, the student. Necessary accommodations will be made for students with disabilities who procure a SAC letter. However, to receive any accommodations self-disclosure, proper documentation, and registration with the SAC office at Loyola University Chicago is required. Accommodations cannot be made until the Lab Coordinator receives proper SAC documentation. Furthermore, accommodations are not retro-active and begin only once appropriate SAC documentation has been received by the Lab Coordinator in a timely manner. Only those accommodations that are specifically listed in the formal SAC letter will be provided. If a SAC letter suggests the Testing Center be utilized, it does not apply for this course as there are no written exams. Read up on [SAC Policies and Procedures](#).

**Academic Integrity:** All students in this course are expected to have read and to abide by the demanding standard of personal honesty, drafted by the College of Arts & Sciences, which can be viewed at: <http://www.luc.edu/media/lucedu/cas/pdfs/academicintegrity.pdf>. The standard of academic integrity and personal honesty delineated in the [College of Arts & Sciences Statement on Academic Integrity](#). Integrity is expected of

every student and will be enforced. Cheating can take many forms in a lab course, but the most common forms are copying data/data analysis, answers to analysis questions, sharing files, or completing Sakai work or other electronic content with another person. The data and analysis, homework, quiz answers, etc. submitted for grading must be your own. If it is not, no credit will be awarded, and no make-up work for those points will be granted. Findings of dishonest academic behavior are reported to the Chair of the Chemistry Department and to the Dean's Office; it is also entered into an individual's record. Copied answers to course work or copied formal lab reports will result in penalty for all students involved. Turn It In is utilized for formal lab reports to identify plagiarism, cheating, and other. Students can converse, brainstorm, and work through strategies together but copying other students' (current or previously in Chem 214) work and presenting it as one's own is unacceptable. There is a difference between sharing knowledge and cheating. If lab reports, data analysis, quizzes, or other materials in this course are plagiarized or have been shared between students (current or past), no credit will be given for the work in question. Cases of suspect academic dishonesty will be handled according to University guidelines. Anything you submit that is incorporated as part of your grade in this course (e.g., quiz, examination, homework, and discussion sheet) must represent your own work. Any students caught cheating will, at the very minimum, receive a grade of "zero" for the item that was submitted, and this grade cannot be dropped. If the cheating occurred during a course exam, the incident will be reported to the Chemistry Department Chair and the Office of the CAS Dean. Depending on the seriousness of the incident, additional sanctions may be imposed.

**Appropriate in Class Behavior and use of Electronic Devices:** Rude, disruptive behavior (such as viewing computer materials not concerning class subjects, texting or talking on phones...) will not be tolerated. Voice recording but not visual recording is allowed for pre-lab lectures. Cell phones, pagers, wireless PDAs, etc. must be turned off during lab. If your device is activated during lab, you must leave the lab immediately and cannot return for the duration of that lab period.

**Lab Experiments/Activities:** All in-person lab experiments and online simulated lab experiments, activities, and/or data analysis are completed individually by students, emphasizing development of an individual's skillset. The experiment/activity topics are located in the lab schedule. Each laboratory topic is approached uniquely. For the in-person lab experiments, students must be present in the laboratory to complete the experiments and collect the necessary data to satisfy the purpose of the experiment. Students will have their own "real-word" or "unknown" sample and have to process [experiment with] it, collect and analyze data, and report final results. There is no substitute for the in-person lab work. If the lab experiment/activity requires data analysis [calculations, etc.] students must report their data of each individual determination (trials), mean/average concentration (or percent composition), standard deviation, and parts per thousand (ppt) associated with the overall determination. Students are NOT permitted to repeat/redo a lab experiment/activity. No exceptions.

#### **Laboratory Safety Points:**

Unsafe actions in the lab are NOT tolerated. All students start with 20 safety points. either earn the points. Deductions are taken for being late or unsafe actions in the lab. A student is told when a safety infraction is witnessed by TA/Instructor and that safety points were deducted. This is documented on the sign-in sheet. Potential safety point deductions:\* Coming late to lab, not signing the sign-in sheet when present, not wearing or needing to borrow borrowing lab goggles or a lab coat, eating/ drinking in lab, chewing gum, taking goggles off in FH-313 when chemicals/glassware are still on any of the 3 lab benches (even if not your chemicals/lab bench), taking mask off or putting mask below nose at any point in the lab, not wearing goggles during lab, touching face/cell phone/personal belongings with gloves on, leaving lab with gloves on, not cleaning up chemical spills on bench top/balances/fume hood, standing/kneeling on chairs, improper chemical disposal, not starting clean-up on time, etc. \*The list is not exhaustive; if an [unlisted] action is unsafe, a student will lose safety points.

**Lab Clean-up:**

Students are REQUIRED to begin cleaning 10 minutes before the official end time of class listed in LOCUS. Students are not allowed to stay past lab time to do wet chemistry under any circumstances NOR can a student gain access to the laboratory room, FH-313, outside of the LOCUS scheduled class day & time.

**Laboratory Quizzes :**

There will be a short quiz on the content for ALL lab experiment/activities. Graded quizzes will be returned the following class and all grades will be posted on Sakai.

**Lab Report Format and General Guidelines**

Lab reports for Quantitative Analysis should be complete, accurate, and detailed. This is an upper division level science class, and more thoroughness is expected of the student. Lab reports MUST be turned in on time (see lab schedule), automatic 20% reduction per day for being late.

Only two experiments will require laboratory reports but these must be done with great care:

- 1) EDTA and IC Analysis of the Hardness of Water
- 2) Spectrophotometric Analysis of Iron(II)

Lab reports consist of the following elements:

Title page – lab experiment name and number centered; your name, lab partners name (for partner labs only), and date the report is due in the lower right-hand corner of the title page

Purpose – brief statement of the reason for performing this experiment.

Materials – two separate lists: one for a listing of all equipment (including the balance used) and the second list for chemicals used (including any unknowns, but excluding any solutions the student makes)

- Concentrations of solutions used should be included. Include concentrations of stock solutions, not concentrations of solutions made. Concentrations of solutions made should be given under the results section.

Procedure – this is a list of all the steps that you did to perform the lab, including any changes that you may have made to the original printed procedure.

- This can be summarized from that listed in the lab handouts.
- It must be so clear that anyone not familiar with the lab would know exactly what to do.
- It should not contain the actual masses, volumes, etc. used by the student.
- Be careful how you write your prep instructions for solutions. You will dissolve/dilute chemicals in a volume smaller than what the final volume will be and then dilute to the final volume mark. For example: Dissolve 12 g KOH in 300 mL DI water, dilute up to 500 mL mark, and shake to mix well.

Results – list data obtained, such as volumes measured, weights, temperatures, in a table format.

- Multiple trials must always be done to verify data as having good precision. All data must be shown, including repeat lab data. Teaching assistants will grade lab reports based on precision.
- Data must be represented in table format with appropriate column and row headings and include the individually determined values, averages (for concentrations, percents, unknowns, etc.), standard deviations, and other necessary values.
- Statistical analysis of your data should also be put in this section.
- If applicable, graphs should go in this section, and they must be clearly labeled with a title and proper x axis and y axis names as well as units. Graphs should be done in Excel.
- Include calculations in this section labeled appropriately with units, chemicals and properly identifying what is being calculated (ex.: Calculation for volume of HCl for 0.1M HCl). The calculations may be written, but please write them neatly so they can be read and understood.



- Show an outline of equation being used and at least one example with your numbers.
- ex.:  $m_1v_1=m_2v_2$        $12\text{ M}(v_1)=0.1\text{M}(1000\text{ mL})$      $v_1=8.33\text{ mL}$
- Please utilize leading zeros before the decimal point (0.1 mL and not .1 mL).
- A paragraph statement of the results must also be present to interpret/summarize the data shown in tables and graphs-
- All reported values MUST be reported with correct units, this includes values in text, tables, and on graphs
- If doing a titration, you need to include the logic behind the use of an indicator which includes color change and chemical explanation for the color change.

Conclusion – a restatement of your results, and what the results mean

- Include a detailed analysis of error (at least 3 errors). This should be done based on the students own data and results. An analysis of error can also be done on theoretical errors as well though the student may not have made these errors.
  - How does the error change the outcome (concentration higher/lower than it should be, etc.)? How does the error affect the subsequent steps in the experiment?
- How can the experiment be improved and/or made simpler?
- How can the student's technique be improved?

Additional Considerations

- Order is also important for excellent scientific work – the lab report write-up should follow the order listed on these directions.
- All parts of this report must be typed (calculations are an exception). Please use at least 11 point font, 1.5 lines spacing for paragraphs, and 1 inch margins.
- Please keep entire tables on a single page. If you must split up a table, remember to include column and row headings again.
- Reports should have good spelling, sentence structure, etc. Do not use run-on sentences, sentence fragments, or misspelled words. Do not use personal pronouns (I, we, me, etc.).
- Take the time to check over your work and re-read your report to make sure that what you wrote is clear and makes sense.
- Make sure to number pages in lab report

The lab report write-up is a VERY IMPORTANT part of a laboratory-based course, especially at the junior and senior undergraduate level, and of course for graduate level work and future employment

## Lab Report Grading Rubric

The following is a rough guideline of how points will be assigned on your lab reports. All lab reports will be out of 200 total points.

Lab Report Categories	Points	Percent
Title Page	20	10
Introduction/Purpose	45	22.5
Results and Data	50	25
Discussion	30	15
Conclusion	20	10
Grammar/Format/Spelling	25	12.5
Proper File Format(Word or PDF and Submission to Sakai	10	5
TOTAL	200	100%

### Lab Notebook Format and General Guidelines

One bound composition type notebook is required, as pages are bound [can't be torn out]. Complete notebook pages in PEN. All in-person lab experiments must have a complete notebook entry written in the lab notebook. Several notebook entries will be formally graded. If the lab data has Excel components you do NOT have to put Excel in the physical lab notebook, but you need to show some example calculations written in the lab notebook [even if the calculation work was done via Excel].

**Before class begins** which means for each class, students should come to lab having organized their lab notebook by writing experiment title, brief introductory paragraph (including the purpose of the lab), and an **outline of the procedures (in your own words) of the experiment to be undertaken**. This is intended to better prepare you for what you are about to undertake beforehand. This should save you a lot of valuable time in the lab. Both instructor and TA will check your notebook and assess if adequate preparation for the lab has been undertaken and then signed/initialed when complete. You will be penalized severely if not done before entry into the lab.

During the lab, students should actively be taking notes on observations, recording masses and volumes of materials used and completing calculations in the lab notebook. ALL data must be written in notebook NOT on scraps of paper. A brief conclusion statement should be added (possibly after leaving) when the lab is completed. Lab notebook does not need to be perfectly organized and neat, but it must be legible. Do not erase any errors that are made, but place a single bold line through the error, or strike-out the error.

At the end of class either instructor or TA will then sign at the bottom of the raw data that your work is complete. Lab notebooks must be signed/initialed before leaving just as if you worked in a commercial or government laboratory.

Notebook Rubrics	Points	Percent
Experimental Title, Purpose, and Outline of Procedure (Pre-Checked)	12	6%
All Data has been included properly and in an organized fashion in lab book	8	4%
Total	20	10%

\* (10 experiments x 20 pts) = 200 pts (10%)

## Grading Policy

The established grading policy is subject to change at Instructor and/or TA discretion. Please note the University uses a +/- grading scale system and it will be implemented in this course.

Grading Category	#	Pts/each	Pts	Percent
Analytical Findings (Accuracy)*	10	100	1000	50%
Detailed Laboratory Reports	2	200	400	20%
Lab Quizzes (top 10/11)	10	30	300	15%
Lab Notebook	10	20	200	10%
Safety Review	10	10	100	5%
Total			2000	100.0%

## Final Grade Assignments:

Points Range	Letter Grade
1800 - 2000	A- to A
1600 – 1799	B- , B, or B+
1400 - 1599	C-, C, or C +
1200 - 1399	D-, D, or D+
Below 1200	F

## Typical Grading Scale (%):

A 100-94.0, A- 93.9-90.0,  
B+ 89.9-86.9, B 86.8-83.0, B- 82.9-79.9,  
C+ 79.8-77.0, C 76.9-72.9, C- 72.8-70.0,  
D+ 69.9-67.9, D 67.8-63.0, D- 62.9-60.0,  
F  $\leq$  59

### TENTATIVE Chem 214 Quantitative Analysis Schedule\* (Fall 2024)

General Topic	Week #	Quiz	Lab Report	Date	Proposed Experiment Details
First Day-Check-in, Safety Review and Syllabus	1			Friday, August 30, 2024	Syllabus, Safety, SF/Equipment, S.J., locker check-in, EXCEL overview
Introduction to Statistics and CaCO <sub>3</sub> & EDTA Prep	2			Friday, September 6, 2024	Statistics Review and Preparation of EDTA and CaCO <sub>3</sub> Solutions
Water Hardness via EDTA	3	Prelab Quiz on EDTA Method		Friday, September 13, 2024	Determination of Total Hardness (Ca & Mg) via EDTA Titration
Water Hardness via Ion Chromatography	4	Prelab Quiz on IC Method		Friday, September 20, 2024	Determination of (Ca & Mg) via Ion Chromatography
Statistics and Intrinsic Sampling Error	5	Prelab Quiz on Statistics		Friday, September 27, 2024	Statistics Review and Excel Setups plus Application to Gravimetric and Volumetric Pipetting (also Prep 0.1M NaOH)
Standardize NaOH & Determine %KHP	6	Prelab Quiz on KHP Titration	<a href="#">Water Hardness Lab Report Due Beginning of Class</a>	Friday, October 4, 2024	Standardize 0.1M NaOH and use to determine Percent of KHP in Unknown
	7			Friday, October 11, 2024	<b>FALL BREAK</b>
Standardize HCl and Determine % Carbonate	8	Prelab Quiz on Carbonate Titration		Friday, October 18, 2024	Standardize 0.1M HCl & use to determine Percent of Carbonate in Unknown
Amino Acid Titration	9	Prelab Quiz on Polyprotic Amino Acids		Friday, October 25, 2024	Amino Acid : pH Titration Curve and Analysis of Acid and Concentration
Chromatography & GC/MS	10	Prelab Quiz on GC		Friday, November 1, 2024	Overview of Principles of Chromatography and GC/MS Demonstration in Forensics Lab
Redox Titration on Vitamin C	11	Prelab Quiz on Redox Titration		Friday, November 8, 2024	Vitamin C Redox Titration Experiment
Spectrophotometric Analysis of Iron	12	Prelab Quiz on Spectroscopy Experiment		Friday, November 15, 2024	UV-Vis Spectrophotometric Analysis of Iron
UV-Vis Standard Addition Method	13	Prelab Quiz on Standard Addition Method	<a href="#">Spectrophotometric Analysis of Fe(II) Lab Report Due Beginning of Class</a>	Friday, November 22, 2024	Standard Addition Method (Tartrazine dye)
	14			Friday, November 29, 2024	<b>THANKSGIVING BREAK</b>
Check Unequal Volume Standard Addition	15	Prelab Quiz on Unequal Volume Addition Method		Friday, December 6, 2024	Unequal Volume Standard Addition (Tartrazine dye) and Also CHECKOUT