

Chemistry 214, Quantitative Analysis Laboratory

Fall 2016 Syllabus

Chem 214-002, Quantitative Analysis Laboratory (1 credit hour), Tuesday/Thursday 2:30-5:15 pm, FH-313

Prerequisite: Chem 102/106 and 112; Chem 222/224 and 226 as well as active attendance or completion of lecture Chem 212.

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Office Hours: 10:00-11am (Wed)

Course Objectives:

- 1) To acquaint students with some of the classical and modern techniques in analytical chemistry
- 2) To teach wet chemical lab skills, efficiency and planning of experiments
- 3) To teach critical evaluation of experimental results
- 4) To become familiar with conventional data collection in commercial and academic laboratories.

Attendance Policy

It is a *requirement* for students is present for every scheduled lab session. Additional time will not be provided to students who are absent from lab or who come late to lab. Students are allowed to attend only the section in which they are enrolled due to university policy. Students must have required materials and be properly dressed to perform experiments in the laboratory. Make-up exams and quizzes will not be given unless approved by the Instructor. If a make-up pre-lab quiz is granted, it must be completed outside of class time and before the next lab session. **Students are required to initial a sign-in sheet on each day of lab**, documenting/verifying their attendance. If you are present in lab but forget to sign-in, a safety point is deducted as accountability is important for safety. The sign-in sheet serves as a formal record. If an absence occurs, it is the student's responsibility to contact the Instructor ASAP.

Footwear/Clothing

Proper clothing and footwear for working in a lab is expected to be worn at all time for each lab. If you are not appropriately clothed (i.e. long pants, lab coat and safety goggles, closed toed shoes, etc.) you will be expected to return to your residence to obtain the appropriate clothing before beginning the day's activities. No extra time will be given to complete the assignment.

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 are 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 most of the lab experiments. **Lab coats & goggles are required and must be worn at all times.** This even applies to cleaning glassware. Lab coats must be fully buttoned to be an effective shield against chemicals.

Laboratory Safety Review:

A safety lecture is given the 1st day of class; attendance is required in order to perform lab experiments. Students must sign a safety sheet acknowledging understanding, commitment to follow policies.

If a student is absent the 1st day and misses the safety lecture, he/she is not allowed to 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 lenses' material may react with chemicals/chemical vapors if an accident occurs and chemicals get into the eye. It is important to understand that all of these safety measures are meant to keep students safe in the laboratory.

Submission of Laboratory Results/Reports:

It is strongly encouraged that all required submissions to Sakai as well as writing & printing lab reports, opening course/data/experiment files, be performed using a reliable wired internet connection [not wireless], that of which the University itself provides in the Information Commons and various computer labs on the Lake Shore Campus. **Under NO circumstances will excuses of "technical difficulties" be accepted** as this syllabus is stating all students should use a wired internet University computer [not wireless internet] to submit work in Sakai, write & print lab reports, open course/data/experiment files.

Required Materials:

- One bound (NO SPIRAL) *laboratory notebook* such as a national-brand Composition book.
- An inexpensive *calculator* having logarithm (base 10 and e), exponential, and trig functions.
- A pair of *lab goggles* [safety glasses NOT allowed], which must be worn at all times in the laboratory.
- *Lab coat*. Offers a layer of protection against hazards. It must be worn at all times during lab experiments. Must be long sleeve. Can be found on Amazon or at the bookstore.
- Chem 214 lab manual and handouts, all handed out on 1st day of lab [always available in Sakai].
- Non-erasable pen [scientists do not write in pencil or erasable ink]. White out is not allowed.
- Familiarity with *sakai.luc.edu* (submission and review of experimental results/data)
- For some experiments, it may be advantageous to bring a laptop computer for data entry, analysis, and calculations. If it is used inappropriately and is deemed to be a distraction/hazard, TA or Instructor may request that it be put away.

Cell phones are NOT allowed for use during quizzes, the midterm, or final exam and strongly discouraged during lab. Further cell phones are not be used as a calculator during lab experiments. If necessary, please take calls in outside hallway after informing the instructor and/or the TA that you will be stepping out. Note, if wearing gloves in lab, gloves must be removed and discarded prior to leaving laboratory for any reason. Failure to conform will result in loss of a safety point for each violation.

Laboratory Schedule:

Students are given all handouts for all experiments beforehand. Handouts are also available in Sakai as a PDF's. A laboratory schedule, detailing projected start/end dates for each lab experiment, pre-lab quizzes, lab report due dates, and other information will be provided to students on the 1st day of class. This schedule will be posted in Sakai and posted near the east entry to FH-313. Therefore, there is no excuse accepted with regard to not knowing what is required of you, the student, every day of lab. Due to unexpected issues, any aspect of the schedule is subject to change. If change might occurs, students are notified to write it on their copy.

Pre-lab Quizzes

At the start of each lab period, students will take the pre-lab quiz (if scheduled). It is essential that the student come to lab prepared, having studied the procedure prior to entering the lab and be cognizant of the purpose and procedures specific to that day's lab. If it is believed that a student is not adequately prepared to undertake the lab, they will be removed from the lab for additional instruction. **Quizzes will be given during the first 15 minutes of lab. Thus, one MUST be punctual in getting to lab on time! If one arrives late to lab, no extra time will be given to complete the quiz.** Quiz answers must be written in pen or credit will not be given.

If absent on the day of a pre-lab quiz, it is the student's responsibility to schedule an appointment with the Instructor to access if there is an adequate justification to make up the pre-lab quiz BEFORE the next lab period; otherwise, the student receives a zero (0) on the missed pre-lab quiz.

Questions will commonly be generated from the procedure or calculations necessary to complete the lab. In some instances, questions may be asked which do not come directly from the procedure but will come from required supplemental materials posted on Sakai or presented during lab overviews. These quizzes will be part of the overall grade for the course. Quiz answers must be written in pen to receive credit.

Overview of Laboratory Procedure:

Following quizzes (if starting new experiment), the TA and Instructor will then present a detailed overview of the day's procedures and goals for the lab experiment prior to its execution. Students are required to have read the experiment procedures in detail ahead of time in order to comprehend and perform the work in a timely and safe manner.

Further, during this overview, students will be informed of any specific hazards, waste disposal procedures, and other safety and equipment related concerns. Students may also be given additional handouts pertinent to that day's assignment.

Periodically during the lab session, the teaching assistant and instructor may help acquaint students with specific details and methodology to be utilized throughout the lab experiment in order to efficiently and accurately perform the experiment. **It is critical that students give their full attention to these recommendations!**

Lab Experiment Unknowns

For every lab, students will be assigned a standard unknown sample whose composition is known to at least **FOUR** significant figures. The student will determine the concentration or percent composition of a particular analyte of interest in the "unknown" sample. Grades will be determined by how accurately the student's experimental determinations reflect the unknown's true composition. Graded Accuracy of laboratory work will determine more than 65% of the course grade.

It is **ABSOLUTELY** necessary that the unknown identifier (usually a letter and number combination) **be recorded in the student's lab notebook as well as be signed for on the unknown list posted by the TA.** The experimental results for each lab must be submitted via Sakai. **NO** e-mail submissions or paper submissions will be accepted. **It is imperative that students turn their results in Sakai in a timely and efficient manner. Labs will only be OPEN for submission of results for a few weeks past initiation of experiment, so it is students' responsibility to submit in data a timely manner.** Accuracy is the main component of the overall grade. Any submission that does not have an unknown

identifier listed or does not report the correct number of significant figures will be given automatic failing score for accuracy of that particular lab.

Reporting Unknown Results: For each lab experiment's unknown, students will report via SAKAI, their data of each individual determination (trials), mean concentration (or percent composition), standard deviation, and parts per thousand (ppt) associated with the overall determination.

Redo's: When the accuracy grade is reported back to the student, he/she then may decide to repeat the lab experiment via a REDO (or not). Students are permitted to repeat each lab experiment **only once** (referred to as a 'redo'), as time permits, to improve technique and potentially earn a better Accuracy Grade. Note, students must submit their data in Sakai and receive an accuracy grade before a 'redo' can be attempted!

In a 'redo' the student must essentially repeat the ENTIRE procedure AND analyze a NEW/DIFFERENT unknown sample and it must be undertaken in the period established on the laboratory schedule. In order to accomplish this, students MUST report experimental results for their unknowns via SAKAI as soon as possible [no later than 24 hours post finishing the entire experiment]. Only after the Sakai submission will the Instructor calculate an accuracy grade.

A final Accuracy Grade is determined as the better of the two reported accuracy findings if a 'redo' is completed.

If the Instructor finds a calculation error in the student's Sakai submission [either first attempt or REDO work], a 5 point deduction is applied to the "fixed" [re-submitted work]. A student must submit **revised data** if Instructor finds a mistake in the calculations. It is not the Instructor's job to proofread calculations submitted in Sakai; ask Instructor or TA questions before submitting work in Sakai.

Students must realize they *cannot* let themselves get behind if they choose to complete a redo. All lab experiments must be completed sequentially as defined in the laboratory schedule. A student CANNOT move on to the next lab experiment until deciding whether to complete a 'redo' of the previous experiment. No retro-activity of a 'redo' is allowed nor are 'redo's' allowed after the 'redo' deadline in the laboratory schedule. Following the time line of the laboratory schedule is required.

Lab experiments are typically completed by students on an individually basis, which emphasizes the development of an individual's set of laboratory skills. For a couple of lab experiments, (Iron, Refractometry, and Polyprotic Acid) there is an *option* to work with one lab partner.

For each experiment's unknown assignment, students will report the values of your individual unknown determinations, the mean concentration (or percent composition) and the standard deviation associated with the overall determination and the parts per thousand precision (ppt). Students will be permitted to repeat each lab only once as time permits in order to earn a better accuracy grade. However, they will need to analyze a **new unknown sample** and it must be undertaken in the period established on the laboratory schedule. If a lab is repeated, the accuracy grade will be the better of the two results.

Laboratory Notebook

It is required that students have bound (not metal spiral) lab notebooks. **At the start of each new experiment, students should come to lab having written an experiment title and date, brief introductory paragraph (including the purpose of the lab for the experiment).** A brief organized list of procedural steps in the assay is recommended but not required. **Students will not be allowed to start an experiment until the notebook has these met these requirements completed.** To enforce this, notebooks are checked at the start of each new lab experiment as well as during Midterm and Final Exams.

All entries into notebook must be completed in PEN and whiteout is NOT allowed. Notebooks must be **organized, neat** and legible but not necessarily perfect. Do not erase any errors that are made, but place a single bold line through the error, or strikeout the error. Do not rip pages out of the notebook or points will be deducted in the notebook grade.

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. Do not record measurements (i.e. weighing's) on scrap paper, all entries should go directly into notebook! A brief conclusion statement should be included when the lab is completed. Thus it is very important that the student stay up to date in the writing of the lab notebook.

Guidelines and a rubric for the lab notebook are found later in the syllabus.

Laboratory Reports

The purpose of the report is to familiarize students with aspects of technical writing in the context of critically analyzing what was done in lab. The laboratory report should present what was done, results, a thorough analysis of the results, and conclusions in a logical and cohesive manner allowing anyone the ability to pick up the lab report, understand what was done, and replicate the experiment.

Lab reports must be computer generated and follow the format defined later in this syllabus. They are to be completed individually. Plagiarizing other students' reports (current or former), book or Internet sources will not be tolerated. **YOU CANNOT COPY** the Chem 214 lab manual text word for word; that is plagiarizing. Rather, reword such text in a manner illustrating your understanding of material. Always, cite outside sources when applicable, which includes citing the Chem 214 lab manual. All experimental data must be included in the lab report. A lab report must contain data from the first attempt and if applicable, a second attempt (redo) if an experiment is repeated. Graded lab reports determine more than 13% of the overall course grade.

Lab report due dates are located on the semester schedule Lab reports are to be computer generated and should follow the format defined later in the syllabus or a similar format. Reports must contain all data sets, including that from a redo if performed. Graded lab reports will determine about 17 % of the overall grade (see breakdown below). Hard copies of the lab reports are to be turned in at the beginning of lab on the respective due date. Electronic (email) submission of lab reports will NOT be permitted.

Reports must be printed and handed to the TA in lab, on the due date, within the first 15 minutes of the official lab start time (2:30 pm). After 3:00 pm, a lab report is considered a day late if it is not in the possession of the TA. There are no exceptions to this statement. Printing issues, Travelling issues, etc. are not an excuse.

Lab reports turned in late will receive a penalty of 10% each day the report is late and result in a grade of 0 if not received within 5 business days (1 week) of the due date.

To assist students in improving writing skills and address any deficiencies, the first written lab report (only) may be corrected and resubmitted (revised) after the first version has been graded to earn back **up to half** of the points lost in the first writing. The corrected lab report must be handed in, accompanied with the original graded lab report and grade sheet or no credit is given to the revised report by the due date established on the class schedule. Students are encouraged to discuss any questions/concerns about lab reports and revisions with the Instructor or TA. The goal of the lab report is to help them develop “reporting” skills, which are critical in business. The remaining two lab reports CANNOT be corrected to earn back points.

The following list* includes the experiments for which a completed lab report is required:

- 1) Determination of % KHP in an Unknown (Acid-Base Titration) (Experiment 1)**
- 2) PolyProtic Acid pH Titration Curve (Titration Curve and Derivatives (Experiment 3)**
- 3) EDTA Determination of Ca and Mg via Titration and Ion Chromatography (Experiment 5)**

*At the discretion of the Instructor or TA, this list can be modified at any time over the course of the semester.

Laboratory Exams

Two written exams will be given which cover concepts pertaining to all of the laboratory experiments. The Midterm exam will include **Experiments 1-3** and the Final exam will include **Experiments 4-8**. Exams cover theory, lab technique, significant figures, dimensional analysis, calculations, and error analysis.

Neither exam is curved. Exam grades are final unless Instructor made a grading error [which must be brought to the Instructor’s attention *no later than 2 days after* the graded exam is returned to the student]. See lab schedule for exam dates. Make-up exams are NOT given under any circumstances, so be present

Safety Points:

Unsafe actions in the laboratory will NOT be tolerated. Each day of lab is allotted 1 safety point. Students either earn the point, or do not. (All or nothing) A student will be told when a safety infraction has been witnessed by TA/Instructor and that a safety point was deducted. This will be documented on the daily sign-in sheet. Safety points count towards 1.06% of the overall course grade.

Safety point deductions occur if Instructor/TA witness unsafe behavior such as:

- Coming late to lab,
- not signing the sign-in sheet when present in the lab,
- not wearing a lab coat,
- borrowing lab goggles or a lab coat,
- eating/drinking in the 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/ or lab bench),
- not wearing goggles when using/cleaning glassware, chemicals, or equipment,
- touching face/cell phone/personal belongings with gloves on,
- leaving laboratory with gloves on,
- not cleaning up spills on bench top/analytical balance/fume hood,
- standing/ or kneeling on chairs,
- improper disposal of chemical disposal, etc.

*This list is not exhaustive; if it is determined an [unlisted] action is unsafe, a student will lose a safety point. IF LABORATORY BENCHES, ANALYTICAL BALANCES, OR OTHER EQUIPMENT IN FH-313 IS LEFT DIRTY, THE ENTIRE CLASS [all students] LOSES THE DAY’S SAFETY POINT.

Lab Clean-up:

Each lab period is scheduled from 2:30-5:15 on Tuesdays and Thursdays. Students must leave the laboratory at 5:15 pm. Students are REQUIRED to begin cleaning their lab bench, equipment, and chemicals, no later than 5:00 pm every day of the scheduled laboratory course. Students are NOT allowed to stay past 5:15 pm to do wet chemistry under any circumstances [unless in an extremely rare case Instructor deems this necessary and allows entire class to do so]

Further students cannot gain access to the laboratory room, FH-313, outside of the scheduled class day/time in LOCUS, with the possible exception when TA or Instructor allows students to enter FH-313 lab a few minutes early on Tuesday/Thursday to sign-in and prepare for the tasks for that day.

Policy for Staying in Lab Course If Dropping Lecture (212):

Students wanting to drop lecture after midterm may stay in the co-req lab only if midterm grade, posted in LOCUS, is a D or better. Students should continue to attend lecture until the week of the drop date to gain as much background knowledge as possible. For Fall 2016, students wishing to drop lecture, and have a mid-term grade of D or better, can seek assistance from the Department of Chemistry and Biochemistry office beginning Monday 10/31 at 9:00 am through Friday 11/4 at 4:00 pm. Students with a midterm grade of F must drop the co-req lab along with the lecture. No exceptions.

Academic Honesty

Instructor and TA encourage students to consult one another during lab experiments and outside of class. Students can converse, brainstorm, and work through questions together but copying other students' work and presenting it as one's own is unacceptable. There is a difference between sharing knowledge and cheating. If it is determined that lab reports or other materials in this course are plagiarized or have been shared between students (current or past), no credit will be given for the assignment. Cases of suspect academic dishonesty will be handled according to University policy and guidelines. Please review Loyola University Chicago's policy on Academic Integrity via this link:

http://www.luc.edu/academics/catalog/undergrad/reg_academicintegrity.shtml

Services for Students with Disabilities (SSWD) Policy:

Necessary accommodations will be made for students with disabilities who procure a SSWD letter. However, extra time in lab to complete experiments is NOT an option. Discuss your academic needs with the Instructor as soon as possible! However, to receive any accommodations self-disclosure, proper documentation, and registration with the SSWD office at Loyola University Chicago is required. Accommodations cannot be made until the Instructor receives proper documentation. Furthermore, accommodations are not retroactive and begin only once the Instructor in a timely manner has received appropriate documentation. Recognize the time the course is scheduled in LOCUS is fixed. No extra time on wet chemistry is given to a student with an SSWD letter; it is simply not possible. Only those accommodations that are specifically listed in the formal SSWD letter will be provided. SSWD Policies and procedures can be found here: <http://www.luc.edu/sswd/>

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	Percent
Analytical Findings (Accuracy)**	1600	65.15%
Lab Reports (100pts/each)	300	12.21%
Pre-lab Quizzes (12pts/each)	96	3.91%
Lab Notebook	150	6.11%
Safety Points	26	1.06%
Quality Assurance Report	34	1.38%
Midterm & Final Exam (125pts/each)	250	10.18%
Total	2456	100.00

*8 labs @ 200pts/each

Points Range	Letter Grade
2211 - 2456	A- to A
1965 - 2210	B-, B, or B+
1719 - 1964	C-, C, or C+
1474 - 1718	D-, D, or D+
Below 1473	F

Lab Report and Notebook Grading Rubrics

The following is a guide provided by the Instructor with an estimate of systematic grading of lab reports and notebooks based on the completion of 8 labs. Points can be redistributed at the discretion of the Instructor and TA if deemed necessary.

Lab Report	Points
Title	5
Introduction/Purpose	15
Procedure	15
Results	35
Conclusion	20
Report Quality (Grammar, spelling, punctuation, organization, etc.)	10
TOTAL	100

* 3 lab reports required = 300 total points

Name/Section on Front of Notebook	4
Table of Contents	16
Title, Date of Experiments Introduction (2 pt./exp.)	16
Introduction (3 pts./exp.)	24
Data, Results, Calculations (6 pts/exp.)	48
Conclusions (4 pts./exp.)	32
Organization (Labeled sections, legible handwriting, etc.)	10
TOTAL	150

Lab Notebook Categories	Points
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Typical Grading Scale* (%):

A 100-94, A- 93-90, B+ 89-87, B 86-83, B- 82-80,
C+ 79-77, C 76-73, C- 72-70, D+ 69-67, D 66-60, F ≤ 59

*subject to change at the discretion of Instructor.