

Analytical Chemistry Course Outline

Fall 2023, Chem 2080 4.0A

Course Instructor: Jennifer Chen

How to address me: Professor or Dr. Chen

Personal Pronouns: (she/her/hers)

Email: jilchen@yorku.ca

Please put "Chem 2080" in the subject

Note: If you have a question or would like to talk with me, you can send an email to make an appointment (on zoom or in-person).

Appointment times: see Calendly link

Office Location: Chemistry Building 456

Lab TA: see eClass

Class Times: Monday and Wednesday, 11:30 am – 1:00 pm

Class Location: R S201

Laboratory Location: CB 343

Course Format: in-person lectures and laboratory. Lectures will be recorded and posted on eClass, however recordings should not be treated as the primary mode of learning because of unexpected technical issues

Prerequisites: CHEM 1000 + 1001

Lab technician: Ha Au and Delwar Hossain

Course Description:

This course introduces the fundamental principles of analytical chemistry. Concepts on sampling, calibration, experimental uncertainty, and statistical data analysis are introduced and applied in laboratory experiments. The principles of solution equilibria including solubility, acid-base, and metal-ligand complexation reactions are fully developed, and titration experiments based on these principles are carried out in the laboratory. An introduction on various analytical techniques including gravimetry and spectrophotometry are presented.

Course Objectives:

At the end of the course students will have developed more in-depth understanding of chemical equilibria and acquired the skills and knowledge to carry out a variety of analytical chemistry measurements. Students will apply statistical and error analysis to correctly interpret, compare and comment on experimental results.

Required textbook:

Quantitative Chemical Analysis by Harris and Lucy 10th edition (8th or 9th edition is fine but corresponding assigned homework problems may be different).

Tentative Schedule:

Classes: Sept. 6 – Dec. 5

Labs start: week of Sept. 18

Thanksgiving and reading week: Oct. 7 - 13

Midterm test: Oct. 30

Final exam: Dec. 7 – Dec. 20 (You must stay for the whole exam period in the event of weather-related rescheduling. See University rules.)

Evaluation:

- Activities (iClicker/Perusall + LON-CAPA assignments) – 10%
- Online Quizzes – 20%[†] (complete 4 out of 5; each quiz is worth 5%)
- Midterm test (in class) – 15%
- Final exam (in class) – 20%[†] (non-cumulative unless non-standard marking scheme)
- Laboratory – 35%

[†]Alternative marking scheme 1: 10% quizzes (count best 2) + 30% final exam (+ 15% midterm test). Final exam will be cumulative (including the first part of the course).

[†]Alternative marking scheme 2: 20% quizzes (count best 4) + 35% final exam (i.e. midterm test dropped). Final exam will be cumulative (including the first part of the course).

**Both lecture and laboratory components must be passed (>50%) independently to pass the course.

Learning Outcomes:

Upon completion of the course, students will be able to:

1. Apply and understand the principles of quantitative analysis, including concepts of sampling, unit conversion, experimental uncertainty, accuracy vs precision, statistical data analysis and methods of calibration.
2. Develop expanded knowledge of chemical equilibria in solution, including:
 - concepts of activity, calculation of activity coefficients and determining how ionic strengths affect equilibria
 - systematic treatment of equilibrium to solve multiple equilibria concomitantly, through algebra or numerical analysis
 - acid/base polyprotic systems and buffers, and selection of pH indicator
 - complexometric reactions involving metal ions and multidentate ligands, determination of concentrations of the species, and the use of metal ion indicator
3. Demonstrate the knowledge and practical experience from laboratory on analytical techniques including, but not limited to, titrations (acid-base, ion-selective electrode, complexation), gravimetry and visible spectroscopy.
4. Apply their knowledge to determine the composition of unknowns in laboratory experiments with the goal of obtaining high accuracy and precision.
5. Be proficient at writing formal lab reports, with emphases placed on data documentation, results interpretation, error analysis, and professional presentation.

COURSE POLICIES AND INFORMATION:

1. Email etiquette:

- **Please use your YorkU email address and put “Chem 2080” in the subject line.** Emails not conforming to the rules may not receive a response.
- As a courtesy and being respectful to your correspondent, write your email professionally (i.e. text-messaging language is unacceptable). Questions regarding calculations or involving equations should be avoided and are best discussed on zoom or in-person.

2. Laboratory:

- There are 8 experiments in total. Please consult the schedule found in the laboratory manual for each lab.
- Information for Lab 1 will be posted on eClass prior to the lab. Hard copy lab manuals will be provided at the first in-person lab.
- Full details on lab evaluation can be found in the lab manual.
- Lab reports must be submitted on Crowdmark AND on the course TurnItIn by the deadline (see lab manual, typically 1 week after the experiment at 11:59pm).
- Students are encouraged to discuss to enrich the understanding of laboratory data. However, **all submitted work must be independent. Copying other people's writing, using someone else's spreadsheet, tables, or equations as "templates" constitute acts of plagiarism.**
- Missed labs:
 - No documentation is required for missed labs.
 - If students know they will miss a lab, they should notify their TA and the Lab technician as soon as possible – within 3 days.
 - The absence of a requirement for documentation does not mean you are free to skip a lab as you wish, for reasons such as a busy schedule. The technician and lab TA are not required to accommodate unjustified reasons for make-up labs.
 - If a lab is missed, there is no guarantee that it can be made up prior to the end of the semester and may have to be made up at a later date.

3. Quizzes, midterm test and final exam:

- Quizzes will be completed online and will be open the night (e.g. 6 pm) before the due date.
- It is the student's responsibility to ensure they are able to generate and upload content for the quizzes (see “Preparing quiz and exam answers for upload” document on eClass).
- Once beginning the quiz, students will have 30 minutes to complete it.
- Missed quizzes:
 - No documentation is required for missed quizzes. There is no make-up quizzes.
- Missed midterm test:
 - No documentation is required. There is no make-up midterm test. The weight of the midterm test will be shifted to the final exam (must complete both parts, i.e. cumulative). Alternative marking scheme 1 does not apply: (grades of 4 quizzes will count for 20%; final exam for 35%).
- Final exam under the normal marking scheme will not be cumulative. Under alternative marking scheme, the final exam will include questions from previous sections.
 - Documentation is required for missed final exam. Deferred standing for final exam is rarely granted and petition to your home faculty will be required. A two-day notice will be given for the makeup final exam. Denied petitions will result in a zero on the final exam. See <http://www.registrar.yorku.ca/petitions/academic/> for information.

4. Activities grade (iClicker, Perusall and Lon-Capa online assignments):

- **WORTH:** 10% of your final grade. Total marks: 70
- **WHY:** Assignments and in-class/clicker-related activities help you learn because you become aware of where you might be struggling. Analytical chemistry requires the *understanding* and *application* of equations and concepts, which are solidified by doing practice problems. Data from previous years also show that students did much better if they attended classes. The activities will also inform me of potential areas of confusion or misconception.
- **WHAT:** Activities include clickers or other online activities (e.g. Perusall), and completion of online assignments.
 - **Clicker Questions:** Each clicker question is worth 1 point; points are awarded for *participation (0.75)* and *correctness (0.25)*. The clicker questions are to help you and thus you should answer them as best you can. There are about 25 points from Clicker.
 - **Other work** (e.g. Perusall) may earn points, when applicable.
 - **LON-CAPA Assignments:** Each correct answer is awarded 1 point. There are 6 assignments and each one will be due on a specified Sunday at 11:59 pm. The assignments are open at least 1-2 weeks before the due date, and as such, you will have plenty of time and opportunity to complete them. Most questions allow multiple attempts. There are ~74 points from Lon-Capa.
 - **Website:** loncapa.sci.yorku.ca. Log in name is your full York email address (XXX@my.yorku.ca) and password is your student ID. Some browsers on mobile phone may not be compatible.
 - Extra problems not for credit are also posted.
- **GRADING:** All points you obtain (from any of the three activities) will count toward the total of 70 points required. Note that iClicker or Perusall would only get you a fraction of the points you need, so you should do Lon-Capa assignments.
 - Additional marks will count as bonus up to a maximum of 77 points (i.e. 110% in Activities grade, or 11% overall).
- Because the marking scheme for Activities already provides flexibility and ability to discard some points/activities, no accommodation will be given to missed assignments or iClicker sessions.
- *Using a clicker not registered to you (or answering clicker questions for a friend) is considered a breach of Academic Honesty.*

Additional course policies:

1. Re-grading of quizzes:

- If students believe a written answer on a quiz was marked incorrectly, a detailed rationale must be submitted to the Course Director within 5 business days of the return of the quiz.
NOTE: re-marking can result in the mark being raised, confirmed, or lowered.

2. Accessibility/Religious accommodations:

- Students registered with Students Accessibility Services must submit the accommodation letters by Sept. 15, 2023 and discuss the accommodations with myself and the lab tech.
- Any religious observance conflicts occurring at any point during the term should be communicated by Sept. 15, 2023, **especially when it concerns with the lab**. Note that most lab sections are full and while the lab instructor will try to accommodate as much as possible; but sometimes it is difficult to reschedule your lab to your desired time.
- Please note: "Senate policy states that students are expected to monitor their progress in courses, taking into account their personal and academic circumstances, and to make the

necessary adjustments to their workload to meet the requirements and deadlines." (from Senate Policy of Students' Responsibilities in the Petition/Appeal Processes).

3. Academic Honesty

- **Any student who breaches York's Academic Honesty Policy will be charged.** It will at minimal result in a visit to the Associate Dean's office. Some offences include:
 - Plagiarism (see White Paper - Plagiarism Spectrum on eClass)
 - Students who misrepresent themselves during iClicker activity, a quiz or examination or provide documentation for absence from any of these that is not legitimate
 - Students who submit any material for remarking that has been modified in any manner to misrepresent the original assessment
 - Students who upload any course material or their laboratory work to websites

Important Information for All Students:

All students are expected to familiarize themselves with the following information, at <https://www.yorku.ca/secretariat/policies/>

- York's Academic Honesty Policy
- Policy on Accommodation for Students with Disabilities
- Code of Student Rights and Responsibilities
- Policy on Religious Observance Accommodation