Western Science
Department of Chemistry

Introductory Analytical Chemistry, Chemistry 2272F, Course Outline

1. Course Information

This course emphasizes the quantitative aspects of chemistry. Starting with classical measurements of volumes and masses, the course will develop statistical tools of estimation, confidence, accuracy, and precision in treating experimental data. This includes an introduction to instrumental methods of analysis.

In the fall term of 2022, Chem 2272F will be lectured in the Middlesex College building, room 105B every Monday, Wednesday and Friday 8:30-9:20 am starting from Friday, September 9, 2022. Chem 2272F has a 3-hour lab each week from the week of September 12, 2022 in room ChB 094 (you are registered in one of the 3 lab sessions and come only in that time slot) and a 1 hour Drop-in session with the instructor each week at 10-11am in ChB226 from the week of September 12, 2022.

List of Prerequisites

Prerequisite: Chemistry 1301A and 1302B or the former Chemistry 1050, 1100A and 1200B, 1020 or 021, 023, 025.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites. Please see http://www.registrar.uwo.ca for more details.

2. Instructor Information

Instructors	Email	Office	Phone	Drop-in hours
Dr. Samantha Gateman (Course Coordinator)	Samantha.gateman@uwo.ca	ChB226	86306	Mondays, 10-11 am
Dr. Chris Levy (Lab Coordinator)	clevy9@uwo.ca			
TA--3 TAs for the weekly labs				

Your instructor's or lab coordinator's email should only be used for administrative purposes. In order to maximize efficiency and to allow your instructor to respond to administrative concerns as quickly as possible, emails of the following nature will *not* be responded to:

- Questions about course material or on how to do a particular problem in the workbook. Such questions should be posted on the OWL forum or discussed during drop-in hours.
- Questions that can be answered based on the information found in this course outline. Being able to find information yourself is an important soft-skill and an employability outcome.
- Requests for grade increases, extra assignments, make-up labs, etc. (see related sections following).

When emailing your instructor, please use your Western email address and include *Chem 2272F* in the subject line. Messages from a non-Western account or those that do not include *Chem 2272F* may be blocked by the university's anti-spam system. It is also useful to include your student number somewhere in the message.

Constructive feedback is very valuable to us. Please do not hesitate to contact any one of the instructors if you have any comments or feedback on any aspect of Chem 2272F. We are always trying to improve the course so that we can improve your experience!

3. Course Syllabus, Schedule, Delivery Mode

This course emphasizes the quantitative aspects of chemistry: classical measurements and instrumental methods of analysis.

Upon successful completion of this course, the student is expected to demonstrate the ability to:

· Describe the basic principles and procedures to perform quantitative chemical analysis.

· Execute effective mathematical calculations necessary to achieve correct values in quantitative analysis.

· Conduct laboratory experiments of quantitative and instrument analysis with accuracy and precision.

· Compile professional level lab reports that are logically and concisely written with critical data analysis.

· Evaluate the accuracy of and sources of errors for a given quantitative or instrument analytical method.

· Work productively in the lab and complete the lab reports independently and on time.

Outline of Planned Lecture Topics

Section	Class Topic	Chapter in Harris
1	Administration, Introduction to Analytical Chemistry	0-1
2	Measurement Basics Experimental Errors Statistics Calibration Methods	3-5
3	Introduction to Titrations	7
4	Systematic Treatment of Equilibrium Acid-Base Equilibria Complexation Equilibria Acid-Base Titrations EDTA Titrations	8-12
5	Fundamentals of Electrochemistry Electrodes and Potentiometry Redox Titrations Electroanalytical Techniques	14-17
6	Fundamentals of Spectrophotometry Spectrophotometers Atomic Spectroscopy	18, 20, 21

In all of the topics, the primary focus is on the *understanding* of the concepts. Please try to garner a thorough, in-depth understanding of the material, because that is what allows success in chemistry. Accordingly tests and exams will be designed to evaluate your comprehension of the material and your ability to apply it to new and different scenarios, and not simply your ability to regurgitate memorized facts or substitute numbers into formulas.

CHEM 2272F LABORATORY SCHEDULE

There are 7 experiments in total. For more information, please read the lab manual.

Week of	Experiment
Sept. 12	Introduction to the Analytical Lab (in lab) Exp. 1: Data Analysis with Excel (online)
Sept. 19	Exp. 2: Titration of an ASA/SA Mixture
Sept. 26	Exp. 3: pH Titration of ASA
Oct. 3	Rotation Week 1 (Exp. 4-6): see posted schedule for details
Oct. 10	Rotation Week 2 (Exp. 4-6): see posted schedule for details
Oct. 17	Rotation Week 3 (Exp. 4-6): see posted schedule for details
Oct. 24	Water Project, Week 1
Oct. 31	No Labs - Fall Break
Nov. 7	Water Project, Week 2
Nov. 14	Water Project, Week 3
Nov. 21	Water Project, Week 4
Nov. 28	Water Project, Week 5
Classes End December 8	

All labs will be in ChB Room 094 (lower ground level in Chemistry Building).

Students who arrive unprepared or late for a lab will receive a zero for that lab. No credit will be given for the prelab exercises. Students are deemed late if they arrive after the lab doors have closed. Lab technicians and teaching assistants have the right to eject students from the lab.

Due to limited resources, students are asked to work in pairs or groups of three in the lab. However, each student is expected to learn all aspects of the experiments. Likewise, each student is expected to contribute equally with their highest level of skills and effort. In the event of unequal contributions, the TAs will require the students to work individually for the remaining of the lab.

Safety and Dress Code

Western is committed to workplace health and safety, and has strict safety regulations. Even your instructor has to follow them! Lab TAs and technical staff will remove students who, in their

opinion, do not meet the safety requirements or are not prepared, as described below. **These students, and those who arrive late, will receive a zero for the entire experiment, and no credit will be given for the prelab exercise.**

Eye Protection

Safety glasses or goggles must be worn by everyone whenever laboratory work, including the getting, cleaning, and returning of glassware, is being performed. Students who wear prescription glasses must wear appropriate safety glasses or goggles over their regular glasses. If you wear contact lenses, you must inform the lab TA that you are wearing contact lenses.

Lab Coat, Pants, Socks, and Footwear

The Occupational Health & Safety Office at Western mandates "shoulder-to-toe" coverage. A detailed description of the dress code is available in the Lab Manual. For hygienic reasons, we do not rent shoes, socks, pants, or lab coats.

Lab coats must be worn, buttoned up. Students must have a lab coat to enter the laboratory. They may not leave after the video or the prelab talk to get a lab coat or have one delivered.

Students must wear ankle-length pants, socks that cover the ankle, and shoes that cover the whole foot (top, sides, and back) without any "cutout holes." Shorts, sandals, and capris are among the items of clothing that are not acceptable. No skin may show at the ankles even when you are seated.

Dates to Note

Date	Event
Friday, September 9	Class begins
Thursday, September 16	Last day to make registration changes, such as lecture and lab sections. This is the last day to de-register from the course and remove it from your academic record.
Week of September 12	First week of laboratory rotations
Monday, October 10	Thanksgiving holiday
Thursday, October 20, 6:30 pm	Midterm Test (topic cut-off TBA)
Week of October 31	Fall Reading Week
Friday, November 12	Last day to drop the course without academic penalty. If you drop the course on or before this date, it will remain on your academic record along with a WDN (withdrawn). If you drop the course after this date, it will result in an automatic F.
Wednesday, December 7	Last day of Chem 2272F lecture

Midterm make-up is scheduled 6:30-8:30 pm on Monday, October 24, 2022.

Contingency plan for an in-person class pivoting to 100% online learning

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either

synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The lab grading might change. Any remaining assessments will also be conducted online as determined by the course instructor.

4. Course Materials

· **Chemistry 2272F Course Textbook is required:** *Quantitative Chemical Analysis*, 10th Ed., **Daniel C. Harris** and **Charles A. Lucy**

The ebook is available at the Western bookstore at the following link:
https://bookstore.uwo.ca/textbook-search?campus=UWO&term=W2022A&courses%5B0%5D=001_UW/CHE2272F

· **Chemistry 2272F computer software:** *Microsoft Excel for data analysis*

· **Chemistry 2272F Laboratory Manual (2022 edition) is required**

Old editions may not be used. Students must bring this year's edition to every experiment.

· **Lab Coat**

For your protection, a proper lab coat is required. Designer lab coats, which are often sold as hospital scrubs or consultation coats, are not acceptable, because they are too short or do not offer sufficient protection to the upper body.

· **Safety Glasses**

Safety glasses may also be purchased through the Chem Club. Times and location will be posted on OWL.

If you wear glasses, it is important that the safety glasses fit over them properly. The safety glasses should sit close to your forehead.

· **Sharp EL-510R(B) or Sharp EL-510RN(B) scientific calculator**

To ensure fairness to everyone in the course, the Sharp EL-510R(B) and Sharp EL-510RN(B) are the only calculator models permitted in the labs and during tests and exams. All other brands and Sharp models will be confiscated. Proctors and instructors for tests and exams do not lend calculators. It is your responsibility to bring the correct calculator and to ensure that it is in proper working order. It's not a bad idea to bring a spare calculator of the same model. Obviously, you will not be allowed to share calculators during tests and exams.

Students are responsible for checking the course OWL site (http://owl.uwo.ca) on a regular basis for news and updates. This is the primary method by which information will be disseminated to all students in the class. All course material will be posted to OWL: http://owl.uwo.ca.

If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk. They can be contacted by phone at 519-661-3800 or ext. 83800.

5. Methods of Evaluation

Tests and exams are necessary to assess your mastery of core concepts. Your overall course grade, out of 100, will be calculated as follows:

Component	Notes	%
Laboratory	See lab manual	35
Midterm Test	Thursday, October 20, 6:30–8:30 pm	25
Final Exam	Scheduled by the Registrar, 3.00 hours	40

To obtain credit for the course, all three requirements below must be met:

1. Obtain a minimum of 50% on the overall course grade, as calculated above.
2. Obtain a minimum of 50% on the laboratory component. This mark is calculated from all experiments. A missed experiment is assigned a mark of zero unless it has been "excused" (see section on Missed Course Components).
3. Miss no more than two experiments, whether excused or not.

Students who fail to meet requirement #2 or #3 will receive a course grade no greater than 40% (even if the calculated course grade is higher) and will not receive credit for the course.

Accommodated Evaluations

Missed Course Components

If you are seeking academic accommodation because of a medical (physical or mental) illness, please begin by contacting the Academic Counselling Office of your home faculty (or affiliated college). Western's policy on academic accommodation for illnesses can be found at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

All requests for academic accommodation must go through your faculty's Academic Counselling Office, so please contact them and *not your instructor*.

If you are a **science student**, the Academic Counselling Office of the Faculty of Science is located in NCB 240, and can be contacted at 519-661-3040 or scibmsac@uwo.ca. Their website is http://www.uwo.ca/sci/undergrad/academic_counselling/index.html.

If you are an **engineering student**, the Academic Counselling Office of the Faculty of Engineering is located in SEB 2097, and can be contacted at 519-661-2130 or engugrad@uwo.ca. Their website is http://www.eng.uwo.ca/undergraduate/about_us/index.html.

Students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are ***not*** permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. All documentation required for absences must be submitted to the Academic Counselling office of a student's Home Faculty.

Missed Labs

There are no make-ups for in-person labs, and it is not possible to reschedule them. If you miss a lab for any reason, you will be assigned a mark of zero for that lab. If the missed lab is due to a reason that is approved by your faculty's Academic Counselling Office, the weight of the lab will be shifted to other labs. **Missing more than two experiments, whether excused or not, will lead to a fail in the labs and therefore a fail of the whole course**.

You must, **as soon as you're able to do so**, submit documentation to your faculty's Academic Counselling Office. If they approve your circumstances, we will be notified.

Tests and exams will contain questions related to the theoretical aspects of the experiments. You are responsible for the material pertaining to the missed labs.

Missed Tests or Final Exam

If you are unable to write the midterm test, contact your faculty's Academic Counselling Office as soon as possible. If your circumstances are approved, you will be able to write the make-up test on **Monday, October 24, 6:30–8:30 pm**. If you are unable to write the makeup midterm test with academic excuse, the weight of the midterm test will be shifted to the Final Exam.

If you are unable to write the Final Exam, contact your faculty's Academic Counselling Office as soon as possible. They will assess your eligibility to write the Special Exam (the name given by the university to a makeup Final Exam) in January of 2022.

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html).

6. Accommodation and Accessibility

Religious Accommodation

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at

https://multiculturalcalendar.com/ecal/index.php?s=c-univwo.

Accommodation Policies

Students with disabilities work with Accessible Education (formerly SSD), which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at:

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf,

7. Academic Policies

The website for Registrar Services is http://www.registrar.uwo.ca.

In accordance with policy,

https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf,

the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at his/her official university address is attended to in a timely manner.

The Sharp EL-510R(B) or Sharp EL-510RN(B) calculator is the only device permitted in the labs and during tests and exams.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following Web site:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

All required papers such as your lab reports may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and Turnitin.com (http://www.turnitin.com).

Computer-marked multiple-choice tests and exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Tests and examinations in this course will be conducted using a remote proctoring service **in the event of health lock-down.** By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at:

https://remoteproctoring.uwo.ca.

8. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: https://www.uwo.ca/sci/counselling/.

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at (519) 661-2147 if you have any questions regarding accommodations.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: https://www.uwo.ca/se/digital/.

Learning-skills counsellors at the Student Development Centre (http://www.sdc.uwo.ca) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Students who are in emotional/mental distress should refer to Mental Health@Western (http://www.health.uwo.ca/mentalhealth) for a complete list of options about how to obtain help.

Additional student-run support services are offered by the USC, http://westernusc.ca/services.

Acknowledgements

This course is supported by the Science Student Donation Fund. If you are a BSc or BMSc student registered in the Faculty of Science or Schulich School of Medicine and Dentistry, you pay the Science Student Donation Fee. This fee contributes to the Science Student Donation Fund, which is administered by the Science Students' Council (SSC). One or more grants from the Fund have allowed for the purchase of equipment integral to teaching this course. You may opt out of the Fee by the end of September of each academic year by completing paperwork in the Faculty of Science Dean's Office. For further information on the process of awarding grants from the Fund or how these grants have benefitted undergraduate education in this course, consult the chair of your department or email the Science Students' Council: ssc@uwo.ca.

Chemistry on Social Media

Find the Department of Chemistry at Western on Facebook and Twitter!

- Facebook: @ChemistryatWestern
- Twitter: @westernuchem