

# Introductory Analytical Chemistry, Chemistry 2272F, Course Outline

## 1. Course Information

### Course Information

Introductory Analytical Chemistry, Chem 2272F, 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. The course includes an introduction to instrumental methods of analysis, such as electroanalytical methods, atomic and molecular absorption spectroscopy as well photoluminescence spectroscopy.

In the fall term of 2021, Chem 2272F will be lectured in room North Campus Building (NCB) 114 every Monday, Wednesday and Friday 8:30-9:20 am starting from Wednesday, September 8, 2021. Chem 2272F has a 3-hour lab each week from the week of September 13, 2021 in room ChB 094 (you are registered in one of the 4 lab sessions and come only in that time slot) and a 45-minute Resource Room with the instructor each week at 6:00-6:45 pm via Zoom from the week of September 13, 2021 (Zoom schedule and links will be posted in OWL).

### 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	Resource Room
Dr. Zhifeng Ding (Course Coordinator)	zfding@uwo.ca	MSA0203	86161	Mondays, 6:00-6:45 pm via Zoom
Dr. Chris Levy (Lab Coordinator)	clevy9@uwo.ca			
TA--4 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 taken to the Resource Room or posted on the OWL forum.
- 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).

If you email your instructor, you must 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 complete the lab reports independently.

Provide the lecture/lab/tutorial schedule (weekly meeting time) and information about delivery mode.

## *Outline of Lecture Topics*

<b>Chapter</b>	<b>Class Topic</b>	<b>Chapter in Harris</b>
1	Administration	
2	Measurement Basics Experimental Errors Statistics	3-4
3	Introduction to Titration	7
4	Systematic Treatment of Equilibrium Activity Acid-Base Equilibria Complexation Equilibria	8-12
5	Electrochemistry Electrodes and Potentiometry Redox Titrations	14-16
6	Atomic Spectroscopy Absorption Spectroscopy Emission Spectroscopy	21
7	Molecular Spectroscopy Absorption Spectroscopy Luminescence Spectroscopy	18,20

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

Week of	Experiment
Sept. 13	Introduction to the Analytical Lab (in lab) Exp. 1: Data Analysis with Excel (online)
Sept. 20	Exp. 2: Titration of an ASA/SA Mixture
Sept. 27	Exp. 3: pH Titration of ASA
Oct. 4	Rotation Week 1: see posted schedule for details
Oct. 11	Rotation Week 2: see posted schedule for details
Oct. 18	Rotation Week 3: see posted schedule for details
Oct. 25	Water Project, Week 1
Nov. 1	No Labs - Fall Break
Nov. 8	Water Project, Week 2
Nov. 15	Water Project, Week 3
Nov. 22	Water Project, Week 4
Nov. 29	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*

For your convenience, a summary of some of the important dates is provided below.

Date	Event
Wednesday, September 8, 2021	Class begins
Thursday, September 16 by noon	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 13	First week of laboratory rotations

Monday, October 18, 6:30 pm	Midterm Test (topic cut-off will be announced by Oct. 8)
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 8	Last day of Chem 2272F lecture

### 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

- **A 3-ply mask is required to wear in the classroom and labs. Full vaccination is required to access campus. Please see the detail announced by the university.**
- **Chemistry 2272F Course Textbook is required: *Quantitative Chemical Analysis*, 10th Ed., Daniel C. Harris and Charles A. Lucy**

Please go to website for renting or purchase:

<https://store.macmillanlearning.com/ca/product/Quantitative-Chemical-Analysis/p/1319164307>

You have the options to purchase just the ebook or to rent it for 6 months from this link.

- **Chemistry 2272F computer software: *Microsoft Excel for data analysis***
- **Chemistry 2272F Laboratory Manual (2021 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.

- **“in-lecture” marks**

Audience response systems (“clickers”) will be used to provide immediate feedback on your understanding of course concepts. You will require a web - enabled device (phone, laptop, etc.) or an iClicker. Please see

[https://presswestern.uwo.ca/students\\_and\\_audience/index.html](https://presswestern.uwo.ca/students_and_audience/index.html)

Participation marks are awarded for the use of “clickers”. You must use your own “clicker” account and may not submit responses for any other student. The data collected using the devices will not be used for research purposes without your consent.

The lecture environment will be engaging and lively with discussion. Research has shown that students who participate are more likely to obtain a better grade in the course. **Come to classes and participate actively!!!**

Even in **Contingency Plan**, audience response systems will be used to provide immediate feedback on your understanding of course concepts. You will require a web - enabled computer. Participation marks are awarded.

- **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 by the method #1 shown below. Method #2 is for

**Contingency plan.** Listed next to the respective components are their maximum contributions toward the course grade.

Component	Notes	Method #1	Method #2
Laboratory	See lab manual	35 (in-person)	25 (all online)
"participation"	Marked on participation only. The score you receive will be based on the percentage of questions answered: 80% or more = 4; 70–79% = 3; 60–69% = 2; 40–59% = 1; Less than 40% = 0	4	4
Midterm Test	Monday, October 18, 6:30–8:30 pm	20	20
Final Exam	Scheduled by the Registrar, 3.00 hours	41	51

**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.

Midterm make-up is scheduled 6:30-8:30 pm on Monday, October 25, 2021.

If permission to waive the requirement that students receive evaluation on work totaling 15% of their final grade at least three days prior to the deadline for withdrawal without academic penalty has been obtained from the Dean's Office, please let Dr. Ding know.

## Accommodated Evaluations

### Missed Course Components

Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the semester, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student's final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (*e.g.*, December and April exams)
- absence of a duration greater than 48 hours,



- assessments worth more than 30% of the student's final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are not met, 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 that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.

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

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_illness.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.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](mailto:scibmsac@uwo.ca). Their website is [http://www.uwo.ca/sci/undergrad/academic\\_counselling/index.html](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](mailto:engugrad@uwo.ca). Their website is [http://www.eng.uwo.ca/undergraduate/about\\_us/index.html](http://www.eng.uwo.ca/undergraduate/about_us/index.html).

A student requiring academic accommodation due to illness must use the Student Medical Certificate ([https://studentservices.uwo.ca/secure/medical\\_document.pdf](https://studentservices.uwo.ca/secure/medical_document.pdf)) when visiting an off-campus medical facility.

#### 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 25, 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](http://www.registrar.uwo.ca/examinations/exam_schedule.html)).

## 6. Student Absences

### Academic Consideration for Student Absences

Students who experience an extenuating circumstance (illness, injury or other extenuating circumstance) sufficiently significant to temporarily render them unable to meet academic requirements may submit a request for academic consideration through the following routes:

- (i) Submitting a Self-Reported Absence (SRA) form provided that the conditions for submission are met. To be eligible for a Self-Reported Absence:
  - an absence must be no more than 48 hours
  - the assessments must be worth no more than 30% of the student's final grade
  - no more than two SRAs may be submitted during the Fall/Winter term
- (ii) For medical absences, submitting a Student Medical Certificate (SMC) signed by a licensed medical or mental health practitioner to the Academic Counselling office of their Faculty of Registration.
- (iii) Submitting appropriate documentation for non-medical absences to the Academic Counselling office in their Faculty of Registration.

Note that in all cases, students are required to contact their instructors within 24 hours of the end of the period covered, unless otherwise instructed in the course outline.

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 that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For the policy on Academic Consideration for Student Absences – Undergraduate Students in First Entry Programs, see:

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_illness.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_illness.pdf)

and for the Student Medical Certificate (SMC), see:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf).

### **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>.

### **Absences from Final Examinations**

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup Final Exam).

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (e.g., more than 2 exams in 23-hour period, more than 3 exams in a 47-hour period).

If a student fails to write a scheduled Special Examination, the date of the next Special Examination (if granted) normally will be the scheduled date for the final exam the next time this course is offered. The maximum course load for that term will be reduced by the credit of the course(s) for which the final examination has been deferred. See the Academic Calendar for details (under [Special Examinations](#)).

## **6. Accommodation and Accessibility**

### **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](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf),

## **7. Academic Policies**

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy,

[https://www.uwo.ca/univsec/pdf/policies\\_procedures/section1/mapp113.pdf](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](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.

The data collected using the "clicker" devices will not be used for research purposes without your consent. Since a "clicker" device is used for the course evaluation, you must use your own "clicker" account and may not submit responses for any other student.

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](mailto:ssc@uwo.ca).

### ***Chemistry on Social Media***

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

- Facebook: @ChemistryatWestern
- Twitter: @westernuchem